Moose
Management Report
of Survey-Inventory Activities
1 July 2001–30 June 2003

Cathy Brown, Editor
Alaska Department of Fish and Game
Division of Wildlife Conservation
December 2004

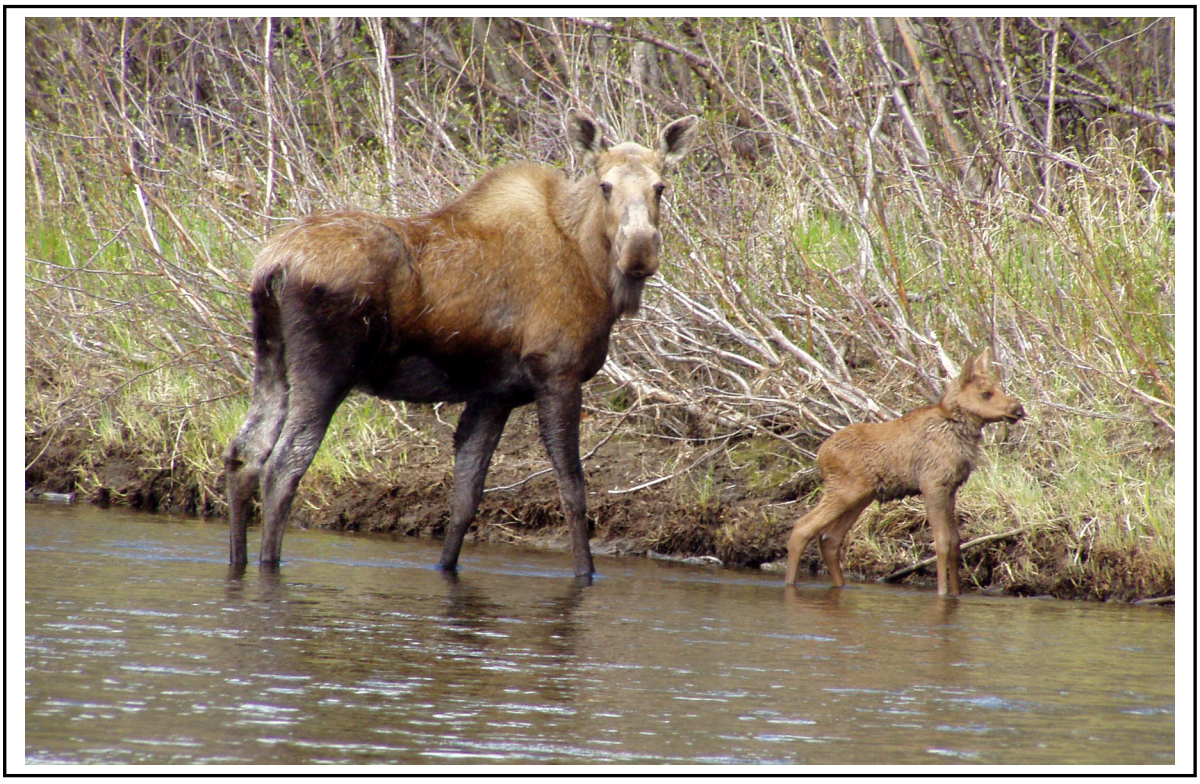

Photo by Randy Rogers, ADF&G

Please note that population and harvest data in this report are estimates and may be refined at a later date.

If this report is used in its entirety, please reference as: Alaska Department of Fish and Game. 2004. Moose Management Report of Survey-Inventory Activities 1 July 2001–30 June 2003. C. Brown, editor. Juneau, Alaska. If used in part, the reference would include the author's name, unit number, and page numbers. Authors' names can be found at the end of each unit section.

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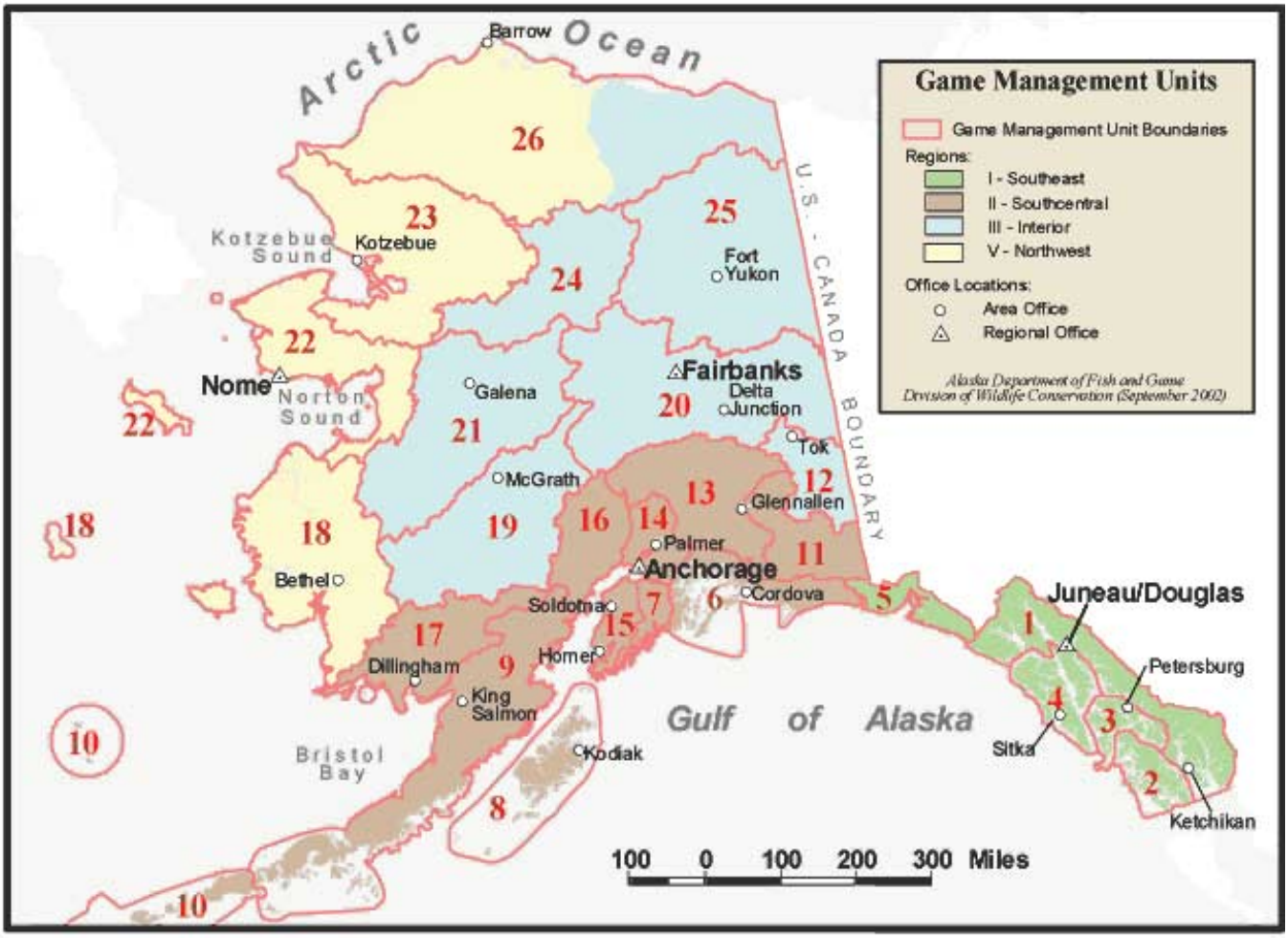
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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 19 (36,486 mi^2); 21A and 21E (23,270 mi^2)

GEOGRAPHIC DESCRIPTION: All of the drainages into the Kuskokwim River upstream from Lower Kalskag; Yukon River drainage from Paimiut upstream to, but not including, the Blackburn Creek drainage; the entire Innoko River drainage; and the Nowitna River drainage upstream from the confluence of the Little Mud and Nowitna Rivers.

BACKGROUND

Moose are a relatively recent faunal addition to western Interior Alaska. According to oral history, their initial discovery was apparently sometime after the turn of the 20th century. As recent as the 1970s, populations were probably at record highs. Currently, moose are found throughout this area, with the exception of the rugged peaks of the Alaska Range. The major factors influencing moose abundance in the area include predation, weather, and hunting. Hunting pressure is thought to be moderate except in a few easily accessible areas. Failure to report harvests, particularly by local residents, is a chronic problem.

Unit 19, as well as Units 21A and 21E, can be conveniently divided into 2 regions that have distinct differences in moose habitat, user access, and hunting practices. Units 19A, 19D, and 21E are generally lower elevation areas accessible by boat. Hunters generally have been local residents living and hunting for food in Unit 19, Unit 21, or adjacent Unit 18. Units 19B, 19C, and 21A are generally higher elevation areas where access is largely restricted to aircraft. Few people live in these areas, and those traveling there to hunt have been mainly seeking large bulls for their trophy quality, although acquisition of meat has been an important consideration as well.

Aerial composition surveys have been the primary means of assessing population status and trend in this large area. There is a history of surveys dating back several decades. Unfortunately, these data are of limited value because of inconsistencies in survey areas and methods. The surveys are also subject to annual variations in weather conditions that affect moose movements and the timing and quality of surveys.

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

Historical moose survey information is limited. A combination of changes in moose survey techniques and the logistical challenges of moose surveys in remote areas has resulted in a discontinuous and often not comparable moose count database. Since the general standardization of survey techniques in the 1980s, we have attempted to establish trend count areas and survey areas to balance the information needs of management with fiscal limitations.

Regulations, including controlled use areas (CUA) and other requirements to manage moose hunting and reduce conflicts between user groups, have existed in the area for many years. The Holitna-Hoholitna CUA consists of the middle to lower portions of the Holitna and Hoholitna Rivers and Titnuk Creek. It is closed to the use of any boat equipped with inboard or outboard motor(s) with an aggregate power in excess of 40 horsepower for the taking of big game, including transportation of big game hunters, their hunting gear, and/or parts of big game, during 1 August through 1 November.

The Upper Holitna–Hoholitna Management Area consists of Unit 19B within the Aniak, Kipchuk, Salmon, Holitna, and Hoholitna River drainages. Hunters in this CUA must stop at a check station. Moose and caribou taken in the area by a hunter who accesses the area by aircraft must be transported out of the area by aircraft. Meat from moose harvested prior to 1 October within the Unit 19A portion of the Holitna-Hoholitna CUA and in all of Unit 19B must remain on the bones of the front quarters and hindquarters until removed from the field or processed for human consumption. Nonresident hunters in Unit 19B must attend an Alaska Department of Fish and Game (ADF&G) approved hunter orientation course. This course involves watching department videos about care of big game meat and judging size and trophy quality of moose antlers.

In Unit 19D the Upper Kuskokwim CUA closes the area to the use of aircraft for moose hunting. This CUA consists of much of Unit 19D upstream from the Selatna River.

In Units 21A and 21E, the Paradise CUA closes the area to the use of aircraft for moose hunting. This CUA includes the area between the Innoko River and the lower Bonasila River near Anvik.

MANAGEMENT DIRECTION

Unit boundaries within the area were designed to provide for 2 major uses of moose. The lowland areas along the Kuskokwim River (Units 19A and 19D) and along the Yukon and lower Innoko Rivers (Unit 21E) have been managed to attempt to provide a sustained, relatively high harvest of moose. The higher elevation portions (Units 19B, 19C, and 21A) have been managed largely for trophy quality animals. Because topography directly affects access, management of the area should continue to be based on these premises.

MANAGEMENT OBJECTIVES

- Annually assess population status, trend, and bull:cow ratios in portions of the area where harvest levels make significant impacts on moose populations.

- Maintain an annual average antler spread measurement of at least 48 inches in Units 19B, 19C, and 21A.

- Assess accuracy of harvest reporting in selected portions of the area.

- Encourage landowners to reduce fire suppression efforts on wildfires that do not threaten human life, property, or valuable resources, so that fire can fulfill its natural role in maintaining young, highly productive, and diverse habitats.

METHODS

We conducted population composition and trend surveys in selected portions of the area using standard aerial survey techniques (Gasaway et al. 1986). We conducted these surveys in 50–100 mi^2 sampling areas with fixed boundaries. We used fixed-wing aircraft to conduct the surveys in the fall after sufficient snowfall occurred, but prior to antler shedding by bulls. Search intensity was usually 3–5 minutes/mi^2, depending on the habitat type and the associated visibility.

We estimated population size in a portion of Unit 21E during February 2000 and in a broad area around the Aniak River in Unit 19A during March 2001 using the Geostatistical Population Estimator technique (GSPE; Ver Hoef 2001). We also used the GSPE to estimate populations in a portion of Unit 19D East in November 2000, October 2001, and November 2003. The survey area included the portion of Unit 19D in the Kuskokwim River drainage upstream from the Selatna River, not including the Takotna River drainage upstream from its confluence with the Nixon Fork. Radiocollared moose observed within a 528-mi^2 area of the larger survey area were recorded during 2001 and 2003 for sightability correction factor (SCF) calculations. A limited late winter survey to estimate calf survival was conducted in the Holitna-Hoholitna drainage of Unit 19A during 8–9 April 2003. Using a Cessna 206 with a pilot and 1 observer, the riparian zones within ½ mile of the Holitna River (from the mouth to Ituliluk Creek) and lower Hoholitna River (from the Holitna River confluence to Big Diamond) were surveyed. Moose were classified as adult or yearling cohorts; classification to gender was not possible due to the absence of antlers on adult males.

We fitted 38 moose (29 adult females, 9 adult males) with radio collars in October 2003. Moose were captured using standard helicopter darting procedures, including the use of an immobilization drug mixture of carfentanil citrate (Wildnil®, Wildlife Pharmaceuticals, Fort Collins, Colorado, USA) and xylazine hydrochloride (Anased®, Lloyd Laboratories, Shenandoah, Iowa, USA). Capturing these moose in the fall presented challenges, partly because of differences in seasonal distribution of moose, open water, lack of snow to help locate moose, and warmer temperatures. Overall the capture project was a success; however, early spring captures are easier to accomplish. Radio collars were distributed on moose in Unit 19A in the lower Holitna River (10 collars), the lower Aniak River drainage (10 collars) and in Unit 19B in the upper Holitna and Hoholitna drainages (18 collars). Flights to track the locations of these radiocollared moose were conducted on a regular basis since they were put in place.

We conducted calf twinning surveys during May and June. They were conducted much like the fall composition and trend surveys, except they were flown beginning in mid May when moose calving starts and continued through early June when leaf out limits sightability. Calf twinning surveys were completed in fixed geographical areas; however, search effort was greatest in meadows and low shrub areas with high sightability.

We monitored harvest by requiring hunters to acquire moose harvest tickets and to report residency, effort, location of hunt, transportation method, commercial services used, success, sex of kill, and antler width. In a portion of Unit 19D, we established a registration hunt in the fall 2001 season to better gather hunter data and to collect teeth from harvested moose to assess the age structure of the harvest. Population and harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY01 = 1 Jul 2001–30 Jun 2002).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Trend

We conducted trend area counts in Units 19A, 19C, and 19D during RY01–RY02. We completed population estimates in Unit 21E in February 2000, the Aniak area in Unit 19A during March 2001, and in Unit 19D in November 2000, October 2001 and November 2003.

Unit 19A. The Unit 19A moose population was declining, based on trend data from the Holitna–Hoholitna trend count area and a density estimate using the GSPE in 1731 mi^2 of the Aniak River drainage in March 2001. Trend area information from the Holitna–Hoholitna drainages indicated observable moose numbers increased from the late 1980s until RY94, when peak numbers of total moose and moose per hour were observed (Table 1a). Trend counts during RY96 and RY97 indicated a decrease in total numbers of moose observed. Trend surveys were not conducted during RY98–RY00 or RY02–RY03 because of poor survey conditions and manpower challenges. The November 2001 trend count indicated very low numbers, including very low bull:cow ratio (6:100), low calf:cow ratios (8:100), and the lowest number of moose per hour ever recorded (59) in the trend area. Some of the decline could have been due to atypical moose distribution caused by shallow snow and relatively temperate late fall weather. The March 2001 GSPE density estimate in the Aniak River drainage was 0.70 moose/mi^2 ($\pm$21%, 90% CI), indicating a moderate late winter moose density for large areas (>2000 km^2) of western Interior Alaska. These data indicated poor calf survival to fall and poor overwinter adult survival. Based on local hunter and trapper information, predation by wolves and an increasing grizzly bear population could be primary factors influencing the moose population.

Unit 19B. No trend count data or population estimates are available for Unit 19B. Moose trend count areas were established sporadically, but were abandoned because early winter snowfall conditions varied greatly, influencing moose distribution and causing extreme variations in the data. However, the moose population in Unit 19B appeared to be stable to declining, based on harvest data and information from local hunters and guides.

Unit 19C. The moose population in Unit 19C was stable to declining based on trend counts (Table 1b). Trend data through fall 1996 showed a population increase. Composition ratios were very similar during RY97 and RY99; however, the total number of observed moose declined during this report period. The RY01 fall survey indicated a continued slow decline in the bull:cow ratio and a stable calf:cow ratio. For the first time, the yearling bull:cow ratio showed a decrease, possibly indicating low calf survival. The total number of moose observed was similar to other years, and the average number of moose observed per hour was similar to RY99. The decline in the bull:cow ratio was due to declining overall numbers. Based on hunter and trapper information, poor calf survival was primarily due to predation by bears and wolves. No survey was conducted in RY02 due to poor survey conditions. The RY03 trend survey indicated a stable bull:cow ratio and improved calf:cow ratio and yearling bull:cow ratio. In addition, the number of moose observed per hour during RY03 was higher than the RY99 and RY01 surveys, indicating the population may be stable.

Unit 19D. The moose population in Unit 19D remained at low densities during this reporting period (RY01–RY02). Low densities are indicative of the low-density equilibrium described by Gasaway et al. (1992) for wolf–bear–moose systems in Alaska and Yukon, Canada. The GSPE completed in November 2000 in Unit 19D East (5204 mi^2) indicated overall moose density was 0.16 moose/mi^2 (±33%, 95% CI). The October 2001 GSPE, completed in the same area as the 2000 survey, was 0.32 to 0.67 moose/mi^2 (90% CI, 84% SCF). The higher 2001 count was attributed to several possible factors including 1) higher survey intensity, 2) better sightability conditions, and 3) randomly drawing more productive sample units.

The November 2003 GSPE survey indicated overall moose density was 0.23 to 0.42 moose/mi^2 (90% CI, 75% SCF). The 2003 survey data should be interpreted with caution because the survey was terminated due to poor weather. Only 50% of sample units in the 528-mi^2 core area and 7% of sample units in the remaining 4676 mi^2 of the survey area were flown. Unit 19D also contains the well-established Candle–Wilson composition/trend count areas where observed numbers of moose fluctuated between 51 and 82 total moose during RY98–RY03 (Table 1c).

Unit 21A. No department trend count data or population estimates are available for Unit 21A. However, based on harvest data, winter observations by trappers, and survey data from the Innoko National Wildlife Refuge, we estimate the moose population in Unit 21A to be stable to declining. Trend data was not collected on a regular basis in the unit. However, anecdotal winter observations by trappers indicated a decline in the overwintering population. Also, staff from the Innoko National Wildlife Refuge estimated a density of 0.64 moose/mi^2 (±29.6%, 90% CI) in the refuge portion of Unit 21A and Unit 21E. Results of this estimate are not directly comparable to our GSPE density measures due to differences in technique.

Unit 21E. The moose population in Unit 21E is believed to have been stable during RY01–RY02. No surveys were conducted in the Holy Cross trend area during RY99–RY03 due to poor survey conditions (Table 1d). Our February 2000 GSPE survey in a 5070-mi^2 portion of Unit 21E indicated a moderate to high density of 1.0 moose/mi^2 and provided a baseline for further population monitoring.

Population Composition

In Unit 19A, bull:cow ratios from 12 fall surveys between RY76 and RY97 in the Holitna River drainage showed some deterioration of the bull:cow ratio, and the RY01 survey indicated further decline (Table 1a). Intense hunting pressure in that area, along with predation from bears and wolves, probably caused some of the declining ratios. Fall calf:cow ratios fell precipitously in this area, indicating low calf survival. This substantiated data gathered during the February 2000 survey along the Hoholitna River. That survey indicated 9-month-old calf survival was <5% (7:152), which was very low. The total number of moose observed was also low during the survey, indicating a declining population in that area.

Unit 19B composition data is largely unknown. However, harvest data indicated a decline in the number of bulls during RY99–RY02 (Table 2a). Anecdotal information collected from several guides indicated a reduction in the number of bulls available over the past few seasons.

The Farewell trend count area represented Unit 19C population composition. In 12 surveys conducted in the Farewell area from RY87 to RY03, notable increases in the moose population were seen through RY96. Data indicated a general decline in the bull:cow ratio from RY97 through RY01. Yearling bull:cow ratios remained relatively steady from RY90–RY99; however, RY01 survey data indicated a decline in the yearling bull:cow ratio. Calf:cow ratios appeared to remain stable. The RY03 survey data indicated stable bull:cow ratios and improved yearling bull:cow and calf:cow ratios (Table 1b).

In Unit 19D the moose population continued at low densities. Bull:cow ratios in the Candle-Wilson count area were low and declined from 13:100 in RY98 to 5:100 in RY03 (no surveys occurred in RY99 and RY02). Yearling bull:cow ratios were very low (2–4:100) and calf:cow ratios varied from 22 to 52:100 cows (Table 1c). Fluctuations could have been due to a combination of decreasing sample size and declining calf survival. The 2001 GSPE survey indicated bull:cow ratios of 19–66:100 and 13–37:100, yearling bull:cow ratios of 3–13:100 and calf:cow ratios of 14–42:100 (90% CI, 84% SCF). The 2003 GSPE survey indicated bull:cow ratios of 13–37:100, yearling bull:cow ratios of 0–13:100 and calf:cow ratios of 30–84:100 (90% CI, 75% SCF). Both the 2003 GSPE and the 2003 Candle-Wilson trend count data indicate that the calf:cow ratios have increased, although the bull:cow ratios remain low. Twinning rates for moose in Unit 19D East were 39% (18 of 46) in 2002, 36% (14 of 39) in 2003, and 39% (12 of 31) in 2004 (Keech and Boudreau 2004).

Units 21A and 21E sex and age composition data were not gathered from the Holy Cross trend count area during RY99–RY03 due to poor survey conditions in the fall. A February 2000 GSPE survey estimated 16% calves in Unit 21E, indicating good production and survival to February. A twinning survey on the lower Innoko in Unit 21A on 4 June 2003 indicated a twinning rate of 30%.

MORTALITY

Harvest

Seasons and Bag Limits.

Bag limits and season dates for RY01 were:

Regulatory Year 2001–2002 Unit and Bag Limits		Open Season
Unit 19A, that portion within the Lime Village Management Area		
RESIDENT HUNTERS: 2 moose; up to 28 moose may be taken by Tier II subsistence hunting permit only; up to 14 permits may be issued.		10 Aug–25 Sep
	Or,	20 Nov–31 Mar
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the Kolmakof River drainage and south of the Kuskokwim River upstream from, but not including, the Holokuk River drainage		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
Or, 1 moose.		1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Remainder of Unit 19A		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19B		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Hunter orientation required.		1 Sep–25 Sep
Unit 19C		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
Or, 1 bull by registration permit RM655.		15 Jan–15 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		1 Sep–25 Sep

Regulatory Year 2001–2002 Unit and Bag Limits		Open Season
Unit 19D, that portion of the Kuskokwim River drainage upstream from and including the Selatna River drainage, except for that portion of the Upper Kuskokwim Controlled Use Area south and east of the Kuskokwim and North Fork Kuskokwim River		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion of the Upper Kuskokwim River Controlled Use Area south and east of the Kuskokwim River and North Fork Kuskokwim River		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		20 Aug–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion between and including the Cheeneetnuk and Gagaryah River drainage, excluding that portion within 2 miles of the Swift River		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep 20
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		1 Sep–20 Sep
Remainder of Unit 19D		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		1 Sep–20 Sep
	Or,	1 Dec–31 Dec
NONRESIDENT HUNTERS:		No open season
Unit 21A		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
	Or,	1 Nov–30 Nov
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep
Unit 21E		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
Or; 1 moose; moose may not be taken within one-half mile of the mainstem of the Yukon or Innoko Rivers.		1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep

Bag limits and season dates for RY02 were:

Regulatory Year 2002–2003 Unit and Bag Limits		Open Season
Unit 19A, that portion within the Lime Village Management Area		
RESIDENT HUNTERS: 2 moose; up to 28 moose may be taken by Tier II subsistence hunting permit; up to 14 permits may be issued.		10 Aug–25 Sep
	Or,	20 Nov–31 Mar
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the drainages of the Kolmakof River and the Holokuk River within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the drainages of the Kolmakof River and the Holokuk River outside the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19A, that portion of the Kuskokwim River downstream from, and including, the drainages of the Kolmakof River and the Holokuk River within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19A		
RESIDENT HUNTERS: 1 bull		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Hunter orientation required.		5 Sep–20 Sep
Unit 19B within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep

Regulatory Year 2002–2003 Unit and Bag Limits		Open Season
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19B		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Hunter orientation required.		1 Sep–25 Sep
Unit 19C		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
Or, 1 bull by registration permit RM655.		15 Jan–15 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19D, that portion of the Kuskokwim River drainage downstream from the Big River drainage and upstream from the Selatna River, but excluding the Selatna River drainage and the Black River drainage		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		1 Sep–20 Sep
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion of the Upper Kuskokwim River upstream from and including the Big River drainage		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		20 Aug–20 Sep
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion between and including the Cheeneetnuk and Gagaryah River drainages, excluding that portion within 2 miles of the Swift River		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Remainder of Unit 19D		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS:		No open season
Unit 21A, within the Nowitna River drainage		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
	Or,	1 Nov–30 Nov

Regulatory Year 2002–2003 Unit and Bag Limits		Open Season
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–20 Sep
Remainder of Unit 21A		
RESIDENT HUNTERS: 1 bull		5 Sep–25 Sep
	Or,	1 Nov–30 Nov
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep
Unit 21E		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
Or, 1 moose; moose may not be taken within one-half mile of the mainstem of the Yukon or Innoko Rivers.		1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep

Few changes were made to the hunting seasons in RY03. Seasons and bag limits during RY03 were:

Regulatory Year 2003–2004 Unit and Bag Limits		Open Season
Unit 19A, that portion within the Lime Village Management Area		
RESIDENT HUNTERS: 2 moose; up to 28 moose may be taken by Tier II subsistence hunting permit only; up to 14 permits may be issued.		10 Aug–25 Sep
	Or,	20 Nov–31 Mar
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the drainages of the Kolmakof and Holokuk Rivers within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS:		No open season
Unit 19A, that portion of the Kuskokwim River upstream from, but not including, the drainages of the Kolmakof and Holokuk Rivers outside the Nonresident Closed Area		

Regulatory Year 2003–2004 Unit and Bag Limits		Open Season
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–5 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19A, that portion of the Kuskokwim River downstream from, and including, the drainages of the Kolmakof and Holokuk Rivers, within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–10 Feb
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19A		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	20 Nov–30 Nov
	Or,	1 Feb–10 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19B within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19B		
RESIDENT HUNTERS: 1 bull.		1 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Hunter orientation required.		1 Sep–25 Sep
Unit 19C		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
Or; 1 bull by registration permit RM655		15 Jan–15 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–20 Sep
Unit 19D, that portion of the Kuskokwim River drainage downstream from the Big River drainage and upstream from the Selatna River, but excluding the Selatna River drainage and the Black River drainage		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		1 Sep–20 Sep

Regulatory Year 2003–2004 Unit and Bag Limits		Open Season
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion of the Upper Kuskokwim River drainage upstream from and including the Big River drainage		
RESIDENT HUNTERS: 1 bull by registration permit RM650.		20 Aug–20 Sep
NONRESIDENT HUNTERS:		No open season
Unit 19D, that portion between and including the Cheeneetnuk and Gagaryah River drainages, excluding that portion within 2 miles of the Swift River		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Remainder of Unit 19D		
RESIDENT HUNTERS: 1 bull.		1 Sep–20 Sep
	Or,	1 Dec–15 Dec
NONRESIDENT HUNTERS:		No open season
Unit 21A, that portion within the Nowitna River drainage		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
	Or,	1 Nov–30 Nov
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–20 Sep
Remainder of Unit 21A		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
	Or,	1 Nov–30 Nov
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep
Unit 21E		
RESIDENT HUNTERS: 1 bull.		5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep

Further changes to the regulations were enacted for the RY04 and RY05 seasons. Most of these changes were in response to the Central Kuskokwim Moose Management Plan (CKMMP) (ADF&G 2004). Changes are described in the next section, and bag limits and season dates for RY04–RY05 are:

Regulatory Year 2004–2005 Unit and Bag Limits		Open Seasons
Unit 19A, that portion within the Lime Village Management Area		
RESIDENT HUNTERS: 2 antlered bulls; up to 28 antlered bulls may be taken by Tier II subsistence permit; up to 14 permits may be issued.	Or,	10 Aug–25 Sep 20 Nov–31 Mar
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19A		
RESIDENT HUNTERS: 1 antlered bull by registration permit RM640.		1 Sep–20 Sep
NONRESIDENT HUNTERS:		No open season in RY04
1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep beginning RY05
Unit 19B within the Nonresident Closed Area		
RESIDENT HUNTERS: 1 antlered bull by registration permit RM640.		1 Sep–20 Sep
Or, 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
NONRESIDENT HUNTERS:		No open season
Remainder of Unit 19B		
RESIDENT HUNTERS: 1 antlered bull by registration permit RM640.		1 Sep–20 Sep
Or, 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side. Hunter orientation required.		5 Sep–20 Sep
Unit 19C		
RESIDENT HUNTERS: 1 bull with spike-fork or 50-inch antlers, or antlers with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Or, 1 bull by registration permit RM655.		1 Feb–28 Feb
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or with 4 or more brow tines on at least 1 side.		1 Sep–20 Sep
Unit 19D, that portion of the Kuskokwim River drainage upstream from the Selatna and Black River drainages but excluding the Takotna River drainage upstream of Takotna village		

Regulatory Year 2004–2005 Unit and Bag Limits	Open Seasons
RESIDENT HUNTERS: 1 antlered bull by registration permit RM650.	1 Sep–25 Sep
NONRESIDENT HUNTERS:	No open season
Unit 19D, that portion of the Takotna River drainage upstream of Takotna village	
RESIDENT HUNTERS: 1 antlered bull by registration permit RM650.	1 Sep–20 Sep
NONRESIDENT HUNTERS:	No open season
Unit19D, that portion between and including the Cheeneetnuk and Gagaryah River drainages, excluding that portion within 2 miles of the Swift River	
RESIDENT HUNTERS: 1 bull.	1 Sep–20 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	1 Sep–20 Sep
Remainder of Unit 19D	
RESIDENT HUNTERS: 1 bull.	1 Sep–20 Sep
NONRESIDENT HUNTERS:	No open season
Unit 21A, that portion within the Nowitna River drainage	
RESIDENT HUNTERS: 1 antlered bull.	5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	5 Sep–20 Sep
Remainder of Unit 21A	
RESIDENT HUNTERS: 1 antlered bull	5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	5 Sep–25 Sep
Unit 21E	
RESIDENT HUNTERS: 1 antlered bull.	5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.	5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. Unit 19D season dates for RY00 were changed during the spring 2000 Alaska Board of Game meeting. We proposed reducing the season to 15 days in September and eliminating the December season, except in the remainder of the unit downstream of the Selatna River. The goal was to slow the decline in bull:cow ratios. The board passed a 5-day season reduction during the fall season throughout the unit and shortened the December season upstream of the Selatna River to 1–15 December.

Included with these changes was a complete elimination of the nonresident season below the Selatna River drainage.

During a special May 2001 meeting in Fairbanks, the board made several changes to the moose season for RY01 in Unit 19D East. The board expanded the size of the Upper Kuskokwim Controlled Use Area for moose hunting to include all the Takotna River drainage and the Kuskokwim drainage south of the Big River to the Selatna River and Black River drainages. The board created a moose registration hunt in Unit 19D East to allow the department to collect more precise information on hunter effort and harvest. The board also passed a proposal to open a small area for nonresidents to hunt moose in the Cheeneetnuk and Gagaryah River drainages, excluding a corridor extending 2 miles north of the Swift River. The board had closed that area during the spring 2000 meeting.

In RY01 the 1–15 December season for any bull in the part of Unit 19D upstream from the Selatna and Black River drainages was closed by emergency order. We also closed the 1–10 February seasons in Unit 19A by emergency order.

During the spring 2002 board meeting in Fairbanks, several changes were made for RY02. A nonresident closed area was created in Units 19A and 19B. This area became closed to the taking of caribou and moose by nonresidents in areas extending 2 miles on either side of, and including, the Holitna River from the mouth of the Chukowan River to the Kuskokwim River; the Titnuk River from Fuller Mountain to the Holitna River; the Hoholitna River from Old Woman Rock to the Holitna River; the Aniak, Salmon, and Kipchuk Rivers from the mouth of Bell Creek of the Salmon River to the Kuskokwim River, including the main channel of the Aniak River downstream from Atsaksovlak Creek, and the Kipchuk River from its confluence with the Aniak River to a point 25 river miles upstream; the Owhat River; the Kolmakof River from its confluence with the Kuskokwim River to a point 5 river miles upstream; the Holokuk River from its confluence with the Kuskokwim River upstream to its confluence with Chineekluk Creek; Veahna Creek; the Oskawalik River from its confluence with the Kuskokwim River upstream to a point 2 miles north of Henderson Mountain; Crooked Creek from its confluence with the Kuskokwim River upstream to Crevice Creek; the George River from its confluence with the Kuskokwim River upstream to the South Fork; the Buckstock River, from its confluence with the Aniak River to a point 5 river miles upstream; the Doestock River from its confluence with the Aniak River to a point 5 river miles upstream; Aniak Slough; and the Kuskokwim River from the mouth of the Holitna River downstream to the boundary of Unit 18.

In Unit 21A in the Nowitna River drainage, the nonresident season was shortened to 5–20 September to align with the lower Nowitna River nonresident season. In Unit 19A the board prohibited hunting for moose and caribou by nonresidents within 2 miles of either side of all rivers in Unit 19A from Kalskag to the Holitna River. This was a compromise between the area guides and local subsistence hunters who had proposed closing the unit entirely to nonresident hunters.

The department supported shortening the RY02 fall season in Units 19A and 19B, but the board decided to maintain the existing seasons. It passed a proposal to reduce the February season in Unit 19A upstream of the Holokuk and Kolmakof drainages from 1–10 February to

1–5 February and changed the bag limit from any moose to bulls only. The board maintained the 1–10 February season in Unit 19A downstream from, and including, the Holokuk and Kolmakof drainages. The board also extended the Holitna-Hoholitna River Management Area to include the Aniak River drainage, requiring hunters who fly into Unit 19B and take big game to also fly out of Unit 19B. This restriction was implemented to address concerns that meat was spoiling during the long raft trip into Unit 19A. These hunters can no longer float downriver from Unit 19B into Unit 19A. The board passed a proposal for the August portion of the Unit 19D moose season changing the border from the riverbank to the drainage, allowing hunters on the North Fork Kuskokwim River to hunt both banks. The board eliminated the December season in Unit 19D East and reduced it to 1–15 December in the remainder of the unit. The board passed a department-amended version of a public proposal to reduce the season in Unit 19C to 1–20 September. The original proposal was to restrict resident hunters to bulls with 50-inch antlers and increase the antler restrictions for nonresidents to 55 or 60 inches.

For RY03 the board shortened the nonresident season in Unit 19C by moving the ending date from 25 September to 20 September and eliminated the February resident season in Unit 21E.

At the spring 2004 meeting, the board changed many area season dates and bag limits for the RY04 season. In Unit 19A the board changed the bag limit in the Lime Village Management Area from 2 moose to 2 antlered bulls, eliminated the hunting season for nonresidents in the entire unit for RY04, and established season dates of 1–20 September for RY05.

In Unit 19B the board shortened all resident and nonresident seasons to 1–20 September. The board also changed the bag limit in the nonresident closed area from 1 bull to 1 antlered bull for resident hunters who choose to hunt with registration permit RM640, or 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least 1 side for resident hunters who choose to hunt with a general season harvest ticket.

In Unit 19C the board changed the bag limit for resident hunters during the September season from 1 bull to 1 bull with spike-fork or 50-inch antlers or antlers with 4 or more brow tines on at least 1 side. Registration hunt RM655 for resident hunters was shortened from 15 January–28 February to 1–28 February. The board changed the nonresident season in Unit 19C to 1–20 September, adding 5 days to the beginning of the season.

In Unit 19D the area for registration hunt RM650 by resident hunters was changed to include the Kuskokwim River drainage upstream from the Selatna and Black River drainages, including the Takotna River drainage, and the bag limit was changed from 1 bull to 1 antlered bull. The season date for RM650 in the Kuskokwim River drainage upstream from the Selatna and Black River drainages but excluding the Takotna River drainage upstream of Takotna village was lengthened to 1–25 September by adding 5 days at the end of the season. The season date for RM650 in the Takotna River drainage upstream from Takotna was shortened to 1–20 September by deleting the August portion of the season. The board made no changes to the nonresident season in Unit 19D between and including the Cheeneetnuk and Gagaryah River drainages, excluding the portion within 2 miles of the Swift River. However, the board eliminated the December season for resident hunters in this area and in the remainder of Unit 19D.

In Units 21A and 21E the board changed the bag limit for resident hunters from 1 bull to 1 antlered bull. The board also eliminated the resident hunters' November season in Unit 21A.

Hunter Harvest. Hunter harvest is reported in Tables 2a–2h. Reported annual moose harvest in Unit 19A continued to decline during RY01–RY02 (average = 81). The average reported annual harvest during RY98–RY02 was 106 (Table 2b). The majority of moose reported taken during RY98–RY02 were bulls (98%), with light cow harvest in February. Because the reporting rate by local hunters was low, actual harvest rates were a minimum of 33% greater.

Annual reported harvests in Units 19B and 19C were probably much closer to actual harvest than in Unit 19A. They averaged 122 and 120 moose, respectively, during RY98–RY02 (Tables 2a and 2d). Harvest in these units declined from RY99–RY00 to RY01–RY02.

In Unit 19D, compliance with reporting requirements had been poor. The 5-year reported kill averaged 95 during RY98–RY02 (Table 2e). We implemented registration hunt RM650 in most of the unit beginning in RY01. This may have increased reporting compliance for the portion of Unit 19D that remained a general season hunt during RY01–RY02. Reported harvest averaged 106 during RY01–RY02, compared to 90 during RY99–RY00 before the registration hunt was implemented.

In Unit 21A, reported moose harvest decreased during the report period, with 85 animals taken on average, compared with an average of 113 during RY99–RY00 (Table 2g). The 5-year average harvest during RY98–RY02 was 103 moose. In Unit 21E reported harvest declined during RY98–RY02, with an average harvest of 181 moose. During RY01–RY02, harvest averaged 168 moose in Unit 21E. The reported harvest of 210 moose in RY97 was the highest on record (Table 2h).

Permit Hunts. Beginning in RY90 a Tier II drawing permit hunt was established for moose hunting in the Lime Village Management Area in Unit 19A. During RY90, 10 permits were issued with a harvest quota of 25 moose of either sex. In RY93 the bag limit was changed to 28 moose with a limit of 2 per permit. Reported harvests were light. For example, the RY98 hunt included 7 moose killed, 1 unsuccessful hunter, and 7 permittees who did not attempt to hunt (Table 3). There was also a federal permit hunt in the same area, with a harvest quota of 40 moose.

In Unit 19C, registration hunt RM655 was established in RY97. The season was 15 January–15 February and excluded the use of aircraft. Hunter participation had been low; however, interest by Nikolai residents has increased. The average reported harvest during RY98–RY02 was 4 moose (range 0–7), with an average of 8 hunters (range 3–18). During the report period (RY01–RY02), 27 permits were issued and 13 moose were harvested.

In RY01 registration hunt RM650 was put into place in Unit 19D East. This was a result of the Unit 19D East planning team meetings. The goal was to more accurately assess hunter effort and success in Unit 19D East. Moose teeth collected from successful hunters in this hunt will be processed and aged to examine the age structure of the population. The number of permits issued decreased from 210 in RY01 to 225 in RY02, and harvest increased from 73 to 98 moose (Table 3).

Antler Size. In RY98–RY02 the average antler size for harvested bulls was 54 inches in Unit 19B, 51 inches in Unit 19C, and 52 inches in Unit 21A. These units had a high proportion of nonresident hunters who were required to take bulls with a minimum antler size of 50 inches. The average antler size was 44 inches in each of Units 19A, 19D and 21E for RY98–RY02. These units had a high proportion of local resident hunters who were not required to take bulls with a minimum antler size. Average antler size during this 5-year period increased slightly in Units 19A, 19B, and 21E; decreased slightly in Units 19C and 19D, and were generally stable in Unit 21A during RY98–RY02.

Hunter Residency and Success. During RY98–RY02 the majority of hunters in Units 19A, 19C, 19D, and 21E were Alaska residents (Tables 4a–4h). Local residents made up the majority of those hunters in Unit 19D. The majority of hunters in Unit 19B and 21A were nonresident hunters. Access, residency restrictions and availability of boat access were likely the primary factors that determined hunter residency.

Hunter residency remained relatively stable during RY98–RY02. Of those who reported hunting in Unit 19A, hunters who lived in Unit 19 accounted for 29% of the total, Alaska residents from outside Unit 19 accounted for 50%, and nonresidents accounted for 21% (Table 4b). Unit 19B hunters consisted of nonlocal Alaskans (37%) and nonresidents (63%) (Table 4c). Hunters in Unit 19C were nonlocal Alaskans (63%) and nonresidents (37%). Very few people live in Units 19B and 19C. Unit 19D hunters were largely local residents (55%), while nonlocal Alaska residents made up 34%, and nonresidents accounted for 11% of the hunters who reported (Table 4e). Residency restrictions in much of the area likely decreased the number of nonresident hunters.

During RY98–RY02, hunter residency varied little from the previous 5-year period. Unit 21A hunters consisted largely of nonresidents (53%) and nonlocal Alaskans (47%). Locals did not report hunting in Unit 21A (Table 4g), and few people live there. This is a shift from predominantly nonresident hunters in Unit 21A during RY96–RY00 to an increase in percentage of nonlocal residents during RY98–RY02. Hunters who reported hunting in Unit 21E during RY98–RY02 were mostly nonlocal residents, primarily from Unit 18 (61%), while 20% were from the 4 villages in the unit and nonresidents averaged 19% (Table 4h).

During RY98–RY02, success rates were stable or declining in the different units (Tables 4a–4h). In Unit 19A the average success rate was 37% and declined from 50% in RY98 to 26% in RY02 (Table 4b). In Unit 19B, success averaged 34% and was relatively stable ranging 31% to 37% (Table 4c). In Unit 19C, success averaged 48% and declined from 52% in RY98 to 42% in RY02 (Table 4d). In Unit 19D success averaged 46% and ranged 35% to 60% during RY98–RY02 (Table 4e). In Unit 21A average success was 49% and ranged from 58% in RY98 to 45% in RY01 (Table 4g). In Unit 21E average success was 74% and declined from 80% in RY98 to 67% in RY02 (Table 4h).

Transport Methods. Transportation methods used by successful moose hunters are reported in Tables 5a–5h. As in previous years, boats were the most commonly used method during the report period (RY01–RY02) in Units 19A, 19D, and 21E, averaging 71%, 84%, and 68%. Aircraft were the second most common method in those units, averaging 21%, 12%, and 17% (Tables 5b, 5e and 5h). In Units 19B, 19C, and 21A, aircraft transportation dominated during

RY01–RY02, averaging 85%, 65%, and 74% (Tables 5c, 5d and 5g). Boats were the second most common method of transport in Units 19B and 21A, averaging 13% and 20%. In Unit 19C, however, the second most common transportation method was 3- or 4-wheelers, averaging 24% during RY01–RY02 (Table 5d). Most of these hunters transported ATVs to the Farewell Station airstrip. Differences in transportation methods in different areas were used to define the original unit boundaries to spatially separate user groups and hunting patterns. Therefore, local hunters have been largely separated from nonlocal hunters since the unit boundaries were last adjusted in the early 1980s.

Other Mortality

Illegal harvests, defense of life or property kills, wounding loss, and funeral potlatch (Table 6) harvests probably account for an additional 150–200 moose deaths annually in Unit 19 and probably 100–150 additional kills in Units 21A and 21E. Of much greater importance to the dynamics of the moose population, however, is predation mortality. Based on trapper questionnaires, pilot reports, and data collected during moose surveys, predation on calves, yearlings, and adults by wolves has been substantial in recent years, as has calf predation by black bears.

HABITAT

Assessment

In forested regions of Interior Alaska, abundant moose browse is generally associated with recent disturbance, such as flooding of riparian habitats and post-fire seral stages on upland sites. In Unit 19D East, over 2300 linear miles of riparian habitat is maintained by shifting rivers in a wide band along the Kuskokwim River and its major tributaries. Additional riparian habitat exists along smaller creeks and around hundreds of boreal lakes and ponds. Limited suppression of naturally occurring wildfires has created a mosaic of vegetation successional stages. During most summers, hundreds of square miles of boreal forest burn throughout the area, creating increased potential for rejuvenation of moose winter forage. In addition, climax stands of subalpine willow persist in bands near treeline in the hills along the north side of the Kuskokwim drainages.

Habitat assessment began prior to predator management experiments to assess potential for a numerical response by moose. In February 2000 we revisited 12 browse transects established during 1989–1994 along the Kuskokwim River near McGrath and found that riparian willows were beginning to outgrow the reach of moose because flooding disturbance had been absent for several years (ADF&G memo, Fairbanks, 25 Feb 2000). The 1999–2000 snowfall in the same area was greater than normal, forcing more moose onto the riparian willow bars. Substantial browsing was documented in these areas. We subsequently used plot-based methods to sample major cover types for estimating forage biomass availability and browsing removal over Unit 19D East (Mar 2001, n = 36 sites) and within the Experimental Micro Management Area (EMMA) near McGrath (Mar 2003, n = 18). The proportion of current annual growth removed over Unit 19D East was 16.0% (95% CI = ±1.2%) and within the EMMA was 15.5% (95% CI = ±1.9%; C.T. Seaton, ADF&G, Fairbanks, unpublished data).

Direct measure of carrying capacity is difficult to estimate for free-ranging wildlife populations because of variability in habitat composition at the landscape scale and annual weather conditions that influence forage production of both summer and winter range and winter energy expenditure. However, the proportional forage removal (above) and twinning rates (30% during 2001) for this area indicate favorable nutritional status compared to other regions of higher moose density in Interior Alaska (C.T. Seaton, ADF&G, unpublished data). Therefore, it is unlikely that the moose population is currently limited by the available habitat near McGrath.

Enhancement

We are exploring habitat enhancement as part of the applied research program to increase the harvestable surplus of moose near McGrath. We continued cooperation with fire management personnel at the Alaska Department of Natural Resources/Division of Forestry to ensure that natural fires are allowed to burn wherever possible. We also completed a prescribed fire plan for portions of Unit 19C in the Farewell area. The potential for mechanical treatment (dozer crushing) of riparian willows was discussed, with cost and logistics being formidable challenges in this remote area. Fortunately, spring flooding conditions along the Kuskokwim River in 2002 produced substantial ice-scouring that helped rejuvenate willow stands growing out of reach of moose. In addition, wildland fires occurred over approximately 325,000 acres of diverse vegetation types in Units 19D, 21A and 19A in summer 2002.

MANAGEMENT PLANNING

In RY99 the Unit 19D East moose population situation gained political attention and the governor appointed a group referred to as the Unit 19D East Adaptive Management Team to develop recommendations for the department to address the moose population declines. The results of the adaptive management team included a 5-year plan to assess the limiting factors of the moose population in Unit 19D East. The major parts of this study were to obtain a more precise estimate of moose density, determine the cause and rate of adult and calf mortality, determine the density of wolves in the area, assess the habitat condition for moose and further develop the research project to be adaptive and build on information as it was gathered. For specific results of that study see the Unit 19D East research performance report (Keech and Boudreau 2004).

ADF&G launched an effort with the Aniak Regional Moose Summit held in October 2002 that led to the CKMMP for Units 19A and 19B. Following the summit, ADF&G formed the Central Kuskokwim Moose Management Planning Committee (CKMC), which developed a CKMMP (ADF&G 2004) in cooperation with ADF&G. The CKMC included representatives of the Central Kuskokwim and other Fish and Game advisory committees, guides, transporters, conservationists and Native organizations, and sought to achieve consensus on moose management recommendations to ADF&G, the Alaska Board of Game, and the Federal Subsistence Board (FSB).

The CKMC conducted meetings in Aniak in February, March, April, August, and October 2003 to develop the draft plan. The preliminary ideas of the CKMC were circulated for public review and comment in July and August 2003. The draft plan was available for public review

and comment from November 2003 through February 2004. There was additional opportunity for public comment through the Alaska Board of Game and FSB regulatory processes.

The CKMC agreed on a broad mission for the plan, the main issues of concern, overall goals and many specific action recommendations. They met in February 2004 to review public comment on the draft plan and develop final recommendations to the Board of Game. After much debate and discussion, the board adopted the CKMC majority recommendations with a few minor revisions. The board and FSB adopted regulatory proposals and endorsed the plan during their spring 2004 meetings.

The CKMMP was finalized in June 2004. The overall problem the CKMMP intended to address was how the moose population in Units 19A and 19B could be restored to avoid impending Tier II hunting restrictions and to maintain opportunities for human use of the resource. Issues and concerns related to the overall problem included moose harvest management, moose habitat, predation on moose, regulation of guides and transporters, information and education, and need for additional data. The purposes of this plan are to restore and maintain the Central Kuskokwim moose population to ensure reasonable subsistence opportunities, provide for high levels of human consumptive use, provide for a diversity of other uses of the moose resource, manage predators and moose habitat, and maintain the overall health of the ecosystem.

After much debate and discussion, the board adopted the CKMC recommendations of the majority of the committee members, with a few minor revisions. The board adopted a modified version of Alternative B that closed Unit 19A to nonresident moose hunting with a 1-year sunset provision. The board also requested ADF&G continue to monitor the moose populations in Units 19A and 19B and report back to them at the March 2005 meeting, specifically to reevaluate the need for the nonresident closure in Unit 19A. The harvest management strategies in the plan recommend that once the moose population increases, restrictions on harvest should be relaxed and hunting opportunities increased.

The draft plan also presented 2 alternative viewpoints on wolf predation control. In keeping with the recommendation of the majority of planning committee members, a proposal for a Wolf Predation Control Implementation Plan was prepared and circulated for public review and comment as part of the draft plan and went through the board public review process for proposed regulations. The Board of Game adopted the regulatory proposal for a Central Kuskokwim Wolf Predation Control Plan under 5 AAC 92.110 and adopted findings to authorize airborne or same-day-airborne shooting of wolves in Unit 19A. The board will review the wolf predation control program at its March 2005 meeting and consider if changes are needed.

The plan includes a strategy to support legislation to establish a Big Game Commercial Services Board that would have authority to limit the total number of guides, transporters and clients in each game management unit. With no limits on the number of commercial operators in specific areas, the main tool available to control hunting pressure is through adjusting resident and nonresident seasons and bag limits and methods and means. Legislation to establish a Big Game Commercial Services Board was introduced during the 2004 legislative session but did not pass.

Successful implementation of the plan and new hunting regulations will require an active wildlife regulation enforcement program in the area. It will be critical for the Alaska Department of Public Safety's Bureau of Wildlife Enforcement (formerly the Division of Fish and Wildlife Protection) to have the support necessary to maintain and/or improve enforcement capabilities in the area.

The CKMC should remain involved in monitoring implementation of the plan and making recommendations to the Board of Game and FSB. The CKMC can continue to serve a role in developing balanced and quality wildlife management recommendations by considering new information that becomes available and developing recommendations for changes, if needed. As with the process to develop this initial plan, recommendations of the planning committee will be brought before the Central Kuskokwim Advisory Committee, other interested advisory committees, federal subsistence councils, and the public for review and comment.

The CKMC has done an excellent job of identifying issues of concern, reviewing all available data, exploring alternatives to address the issues, and seeking to reach consensus on recommendations to ADF&G and the Board of Game. The Division of Wildlife Conservation greatly appreciates the dedication of extensive time and effort by the committee members in their months of deliberations. While agreement has not been reached on all issues, committee members listened to each other with respect and people with diverse interests in wildlife management learned to understand each other better.

CONCLUSIONS AND RECOMMENDATIONS

Populations over the reporting area were stable to declining, with considerable variation both within and between years. Data from the report period indicated potential declining populations in all units surveyed except Unit 19D, where the population appears to have stabilized at low densities. Unit 19D was the only area that indicated a stable population based on the number of moose observed compared to the previous reporting period. However, the bull:cow ratios in the trend area continued to decline through RY03. Calf:cow ratios were stable.

We completed density estimates in Units 21E (February 2000), 19A (March 2001), and Unit 19D (fall 2000, 2001 and 2003). This will help us further assess the status of the populations. The fall weather conditions, along with fiscal and manpower challenges, continued to challenge the McGrath moose survey-inventory program. Annual data collection efforts (trend and composition counts) in as many units as possible are the best and most cost-effective way to assess yearly changes in population composition and to monitor population trends.

We accomplished much of our objective to assess population status, trend and bull:cow ratios in portions of the units where harvest levels make significant impacts on moose populations. However, efforts will be made during the next reporting period to improve data collection in the western portion of Units 19B, 19C and 21A. This is the first step in developing sound long-term management plans for moose in this area.

We met our objective to maintain an annual average antler spread measurement of at least 48 inches in Units 19B, 19C and 21A during this reporting period. This objective was designed as an index to the population status of large bulls and overall hunter success.

We made some progress on our objective to assess the accuracy of harvest reporting in portions of the area. We reviewed subsistence harvest surveys and compared them to reported harvests. During the next reporting period, efforts will be made to implement a system to better assess reporting rates in selected areas, primarily Units 19A and 21E. These units have historically poor reporting and have sparked increasing debate over the population levels, trends, and the impact of all sources of mortality, including hunting. Ongoing registration hunt reporting and subsistence surveys will probably allow us to achieve this objective during the next report period.

We accomplished our objective to encourage wildfires. We maintained communications with DNR Forestry and the local Native corporations to advocate a "let burn" policy when possible. We also worked to alter some fire management zones from the full suppression category to modified or limited suppression to increase options for land managers. We will continue to revise the Farewell prescribed burn plan that was attempted in 2000. The prescription will be changed and hopefully this burn will occur in the next reporting period.

During the next reporting period the objectives will be:

- Annually assess population status, trend, and bull:cow ratios in portions of the area where harvest levels make significant impacts on moose populations.

- Maintain an annual average antler spread measurement of at least 48 inches in Units 19B, 19C, and 21A.

- Assess accuracy of harvest reporting in selected portions of the area.

- Encourage landowners to reduce fire suppression efforts on wildfires that do not threaten human life, property, or valuable resources, so that fire can fulfill its natural role in maintaining young, highly productive, and diverse habitats.

In Units 19A and 19B additional objectives, which were recommended in the CKMMP, will be:

- Minimum fall posthunt bull:cow ratio of 2-30 bulls:100 cows.

- Minimum fall posthunt calf:cow ratio of 30-40 calves:100 cows.

- No less than 20% short yearlings (calves from the previous year/total adults) in late winter surveys.

In Units 19A and 19B additional activities, which were recommended in the CKMMP, will be:

- Assemble a moose biology and management educational curriculum for rural high school students in the Central Kuskokwim region. The curriculum was provided to teachers in all the schools in Unit 19A communities.

- Distribute an issue of the Central Kuskokwim Moose Planning News in April 2004 to inform local residents, hunters, and others about the actions taken by the Board of Game.

- Prepare posters about the changes in moose hunting regulations and use of registration permits.

- Fit 38 moose with radio collars in Unit 19A in the lower Holitna River (10 collars), the lower Aniak River drainage (10 collars), and in Unit 19B in the upper Holitna and Hoholitna drainages (18 collars). Conduct flights to track the locations of these radiocollared moose.

- Subsistence Division will conduct household surveys of big game harvest in Unit 19A communities and with teachers in the Kuspuk School District to involve students in collecting household subsistence use data.

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TABLE 1A Holitna-Hoholitna Count Area (Unit 19A) fall aerial moose composition counts, regulatory years 1987–1988 through 2002–2003

Regulatory year	Bulls:100 cows	Yearling bulls:100 cows	Calves: 100 cows	Calves	Percent calves	Adults	Moose	Moose/ Hour
1987–1988	22	4	72	50	36	84	140	85
1988–1989	31	16	56	103	30	240	343	95
1989–1990	24	13	55	160	30	361	528	163
1990–1991	26	10	52	139	29	336	475	162
1991–1992[a]								
1992–1993	31	15	63	172	32	360	542	169
1993–1994[a]								
1994–1995	14	2	42	209	27	568	778	251
1995–1996[a]								
1996–1997	22	10	50	146	29	355	502	152
1997–1998	14	11	34	85	23	286	371	169
1998–1999[a]								
1999–2000[a]								
2001–2002	6	3	8	13	7	183	196	59
2002–2003[a]								

[a] No survey.

TABLE 1B Farewell Burn Count Area (Unit 19C) fall aerial moose composition counts, regulatory years 1987–1988 through 2003–2004

Regulatory year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose	Moose/ Hour
1987–1988	53	10	19	32	13	207	242	115
1988–1989	58	20	34	47	18	218	265	126
1989–1990	47	15	22	55	13	361	416	194
1990–1991	43	8	26	58	16	315	373	159
1991–1992	44	8	29	59	17	293	352	156
1992–1993	46	8	38	58	21	220	278	100
1993–1994[a]								
1994–1995	52	10	19	45	11	353	404	170
1995–1996[a]								
1996–1997	46	11	15	43	10	411	454	158
1997–1998	30	10	27	75	17	368	443	174
1998–1999[a]								
1999–2000[b]	33	11	27	42	17	206	248	86
2000–2001[a]								
2001–2002	25	3	25	76	17	377	454	81
2002–2003[a]								
2003–2004	25	8	34	65	21	240	305	110

[a] No survey.
[b] Fall 1999 – only 77.5% of the survey area flown.

TABLE 1C Candle–Wilson A, B, C, and D count areas (Unit 19D) fall aerial moose composition counts, regulatory years 1996–1997 through 2003–2004

Regulatory year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose
1996–1997	18	7	34	19	21	66	95
1997–1998	13	6	52	25	32	54	79
1998–1999	13	4	34	13	23	43	56
1999–2000[a]							
2000–2001	9	2	29	16	20	61	77
2001–2002	6	2	22	14	17	68	82
2002–2003[a]							
2003–2004	5	3	29	11	21	40	51

[a] No survey.

TABLE 1D Holy Cross (Unit 21E) fall aerial moose composition counts, regulatory years 1987–1988 through 2002–2003

Regulatory year	Bulls: Cows	Yearling bulls:100 Cows	Calves: 100 Cows	Calves	Percent calves	Adults	Moose	Moose/ hour
1987–1988	19	9	43	150	26	420	570	83
1988–1989[a]								
1989–1990	31	12	45	148	25	432	584	161
1990–1991	29	7	51	211	28	536	758	253
1991–1992[a]								
1992–1993	26	5	22	67	14	412	483	163
1993–1994[a]								
1994–1995	29	9	63	216	32	444	674	234
1995–1996[a]								
1996–1997	30	11	34	158	21	604	762	186
1997–1998[a]								
1998–1999	26	11	35	77	22	276	353	103
1999–2000[a]								
2000–2001[a]								
2001–2002[a]								
2002–2003[a]								

[a] No survey.

TABLE 2A Unit 19B moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1994–1995	163	(100)	0	(0)	0	163	54	217
1995–1996	136	(100)	0	(0)	0	136	45	181
1996–1997	166	(100)	0	(0)	0	166	55	221
1997–1998	158	(100)	0	(0)	1	159	52	211
1998–1999	152	(100)	0	(0)	1	153	50	203
1999–2000	108	(100)	0	(0)	4	112	37	149
2000–2001	152	(100)	0	(0)	1	153	50	203
2001–2002	112	(100)	0	(0)	0	112	37	149
2002–2003	80	(100)	0	(0)	1	81	27	108

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2B Unit 19A moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1994–1995	160	(95)	8	(5)	0	168	55	223
1995–1996	137	(99)	2	(1)	2	141	47	188
1996–1997	174	(96)	8	(4)	2	184	61	245
1997–1998	136	(96)	6	(4)	0	142	47	189
1998–1999	130	(90)	14	(10)	2	146	48	194
1999–2000	103	(90)	11	(10)	4	118	39	157
2000–2001	106	(100)	0	(0)	0	106	35	141
2001–2002	91	(99)	1	(1)	3	95	31	126
2002–2003	67	(100)	0	(0)	0	67	22	89

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2C Unit 19 moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1986–1987	454	(98)	8	(2)	2	464	153	617
1987–1988	530	(97)	17	(3)	2	549	181	730
1988–1989	615	(98)	15	(2)	7	637	210	847
1989–1990	546	(99)	7	(1)	6	559	184	743
1990–1991	383	(95)	20	(5)	1	404	133	537
1991–1992	461	(97)	13	(3)	2	476	157	633
1992–1993	485	(95)	24	(5)	3	512	169	681
1993–1994	542	(99)	3	(1)	2	547	181	728
1994–1995	581	(99)	8	(1)	0	589	194	783
1995–1996	527	(99)	2	(1)	6	535	176	711
1996–1997	621	(99)	8	(1)	3	632	208	840
1997–1998	561	(99)	7	(1)	4	572	189	761
1998–1999	535	(97)	14	(3)	3	552	182	734
1999–2000	442	(97)	13	(3)	11	466	153	619
2000–2001	478	(100)	0	(0)	2	480	158	638
2001–2002	420	(99)	1	(1)	3	424	140	564
2002–2003	355	(100)	0	(0)	2	357	118	475

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2D Unit 19C moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1994–1995	152	(100)	0	(0)	0	152	50	202
1995–1996	127	(100)	0	(0)	0	127	42	169
1996–1997	153	(100)	0	(0)	0	153	50	203
1997–1998	140	(100)	0	(0)	0	140	46	186
1998–1999	149	(100)	0	(0)	0	149	49	198
1999–2000	130	(99)	1	(1)	0	131	43	174
2000–2001	122	(100)	0	(0)	1	123	41	164
2001–2002	111	(100)	0	(0)	0	111	37	148
2002–2003	84	(100)	0	(0)	1	85	28	113

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2E Unit 19D moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1994–1995	106	(100)	0	(0)	0	106	35	141
1995–1996	109	(100)	0	(0)	3	112	37	149
1996–1997	102	(100)	0	(0)	1	103	34	137
1997–1998	103	(99)	1	(1)	1	105	35	140
1998–1999	86	(100)	0	(0)	0	86	28	114
1999–2000	93	(100)	0	(0)	2	95	31	126
2000–2001	84	(100)	0	(0)	0	84	–[b]	–[b]
2001–2002	96	(100)	0	(0)	0	96	–[b]	–[b]
2002–2003	116	(100)	0	(0)	0	116	–[b]	–[b]

[a] Unreported harvest estimated at 33% of total reported harvest.
[b] RM650 registration hunt.

TABLE 2F Units 21A and 21E moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1986–1987	227	(95)	11	(5)	0	238	79	317
1987–1988	251	(98)	6	(2)	0	257	85	342
1988–1989	306	(98)	6	(2)	5	317	105	422
1989–1990	277	(99)	1	(1)	0	278	92	370
1990–1991	304	(99)	3	(1)	3	310	102	412
1991–1992	284	(99)	4	(1)	0	288	95	383
1992–1993	223	(99)	2	(1)	0	225	74	299
1993–1994	241	(99)	2	(1)	0	243	80	323
1994–1995	276	(97)	10	(3)	0	286	94	380
1995–1996	273	(98)	6	(2)	0	279	92	371
1996–1997	306	(95)	15	(5)	0	321	106	427
1997–1998	316	(98)	6	(2)	1	323	106	429
1998–1999	298	(97)	8	(3)	0	306	101	407
1999–2000	288	(98)	6	(2)	4	298	98	396
2000–2001	300	(99)	4	(1)	0	304	100	404
2001–2002	245	(91)	24	(9)	3	272	90	362
2002–2003	220	(93)	17	(7)	2	239	79	318

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2G Unit 21A moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1994–1995	124	(99)	1	(1)	0	125	41	166
1995–1996	116	(100)	0	(0)	0	116	38	154
1996–1997	130	(100)	0	(0)	0	130	43	173
1997–1998	113	(100)	0	(0)	0	113	37	150
1998–1999	111	(100)	0	(0)	0	111	37	148
1999–2000	123	(100)	0	(0)	1	124	41	165
2000–2001	103	(100)	0	(0)	0	103	34	137
2001–2002	89	(99)	1	(1)	3	93	31	124
2002–2003	81	(99)	1	(1)	0	82	27	109

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 2H Unit 21E moose harvest, regulatory years 1994–1995 through 2002–2003

Regulatory year	Harvest by hunters: Reported M	(%)	F	(%)	Unk	Total	Estimated unreported[a]	Total
1994–1995	152	(94)	9	(6)	0	161	53	214
1995–1996	157	(96)	6	(4)	0	163	54	217
1996–1997	176	(92)	15	(8)	0	191	63	254
1997–1998	203	(97)	6	(3)	1	210	69	279
1998–1999	187	(96)	8	(4)	0	195	64	259
1999–2000	165	(96)	6	(4)	3	174	57	231
2000–2001	197	(98)	4	(2)	0	201	66	267
2001–2002	156	(87)	23	(13)	0	179	59	238
2002–2003	139	(90)	16	(10)	2	157	52	209

[a] Unreported harvest estimated at 33% of total reported harvest.

TABLE 3 Permit hunt results from Lime Village Tier II (TM684) and Unit 19C (RM655) and Unit 19D (RM650), regulatory years 1992–1993 through 2002–2003

Unit/ Hunt no.	Regulatory year	Successful hunters	Unsuccessful hunters	Did not hunt	Total reports
19A/TM684	1992–1993	9	4	3	16
	1993–1994	12	2	6	20
	1994–1995	7	1	6	14
	1995–1996	5	3	7	15
	1996–1997	4	1	9	14
	1997–1998	5	2	7	14
	1998–1999	7	5	16	28
	1999–2000	3	9	14	26
	2000–2001	2	3	11	16
	2001–2002	5	8	6	19
	2002–2003	1	4	9	14
19C/RM655	1997–1998	1	0	0	1
	1998–1999	2	1	0	3
	1999–2000	0	3	1	4
	2000–2001	4	2	0	6
	2001–2002	6	2	1	9
	2002–2003	7	7	4	18
19D/RM650	2001–2002	73	137	67	277
	2002–2003	98	127	40	265

TABLE 4A Unit 19 moose hunter residency and success, regulatory years 1986–1987 through 2002–2003

Regulatory year	Successful						Unsuccessful						Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	
1986–1987	89	191	119	47	446	(54)	101	183	77	15	376	(46)	822
1987–1988	121	245	162	21	549	(54)	95	280	94	6	475	(46)	1024
1988–1989	110	285	188	54	637	(54)	132	271	105	28	536	(46)	1173
1989–1990	114	134	185	36	469	(45)	95	305	162	5	567	(55)	1036
1990–1991	81	189	111	23	404	(37)	94	329	232	20	675	(63)	1079
1991–1992	87	259	123	7	476	(47)	122	266	141	5	534	(53)	1010
1992–1993	100	256	113	41	510	(48)	123	257	149	18	547	(52)	1057
1993–1994	89	271	153	30	543	(53)	57	247	166	6	476	(47)	1019
1994–1995	121	276	181	18	596	(45)	124	368	224	16	732	(55)	1328
1995–1996	91	263	170	11	535	(44)	159	325	194	8	686	(56)	1221
1996–1997	113	295	212	12	632	(52)	123	258	202	2	585	(48)	1217
1997–1998	113	223	227	9	572	(48)	99	251	253	9	612	(52)	1184
1998–1999	93	221	210	28	552	(45)	69	312	289	11	681	(55)	1233
1999–2000	94	206	149	17	466	(41)	103	292	264	9	668	(59)	1134
2000–2001	77	209	184	10	480	(42)	95	268	294	5	662	(58)	1142
2001–2002	107	174	132	11	424	(35)	182	367	239	9	797	(65)	1221
2002–2003	110	111	131	5	357	(35)	191	282	167	10	650	(65)	1007

TABLE 4B Unit 19A moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful						Unsuccessful						Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	
1994–1995	56	82	23	7	168	(46)	61	107	26	2	196	(54)	364
1995–1996	28	83	23	7	141	(46)	58	89	15	1	163	(54)	304
1996–1997	42	119	20	3	184	(54)	51	86	18	0	155	(46)	339
1997–1998	44	77	19	2	142	(51)	33	67	35	3	138	(49)	280
1998–1999	56	65	19	6	146	(50)	24	89	32	1	146	(50)	292
1999–2000	45	46	21	6	118	(43)	54	76	25	4	159	(57)	277
2000–2001	20	51	31	4	106	(36)	50	74	60	2	186	(64)	292
2001–2002	22	53	11	9	95	(32)	43	114	39	3	199	(68)	294
2002–2003	19	29	18	1	67	(26)	61	90	31	4	186	(74)	253

TABLE 4C Unit 19B moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful						Unsuccessful						Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	
1994–1995	0	71	88	4	163	(40)	0	128	108	9	245	(60)	408
1995–1996	0	66	69	1	136	(41)	0	82	107	5	194	(59)	330
1996–1997	0	54	107	5	166	(47)	0	79	103	2	184	(53)	350
1997–1998	0	41	114	4	159	(40)	0	83	147	5	235	(60)	394
1998–1999	0	48	100	5	153	(37)	0	80	175	6	261	(63)	414
1999–2000	0	44	59	9	112	(32)	0	78	159	5	242	(68)	354
2000–2001	1	59	88	5	153	(36)	7	99	161	1	268	(64)	421
2001–2002	1	42	68	1	112	(31)	2	106	134	4	246	(69)	358
2002–2003	1	14	65	1	81	(35)	1	66	80	1	148	(65)	229

TABLE 4D Unit 19C moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1994–1995	0	98	53	1	152 (52)	0	85	53	1	139 (48)	291
1995–1996	0	78	49	0	127 (49)	0	88	42	0	130 (51)	257
1996–1997	0	89	62	2	153 (60)	0	61	41	0	102 (40)	255
1997–1998	1	68	69	2	140 (58)	0	64	37	0	101 (42)	241
1998–1999	1	75	72	1	149 (52)	0	82	53	1	136 (48)	285
1999–2000	0	79	50	2	131 (50)	0	81	48	0	129 (50)	260
2000–2001	0	69	54	0	123 (50)	0	69	50	2	121 (50)	244
2001–2002	0	74	37	0	111 (44)	0	106	34	2	142 (56)	253
2002–2003	0	48	35	2	85 (42)	0	93	23	0	116 (58)	201

TABLE 4E Unit 19D moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1994–1995	57	38	6	5	106 (45)	56	49	21	5	131 (55)	237
1995–1996	53	38	19	2	112 (43)	84	44	16	2	146 (57)	258
1996–1997	56	33	14	0	103 (49)	67	22	18	0	107 (51)	210
1997–1998	54	34	17	0	105 (54)	55	23	12	1	91 (46)	196
1998–1999	28	28	15	15	86 (49)	34	45	10	3	92 (51)	178
1999–2000	45	35	15	0	95 (46)	37	52	24	0	113 (54)	208
2000–2001	48	32	3	1	84 (60)	26	26	4	0	56 (40)	140
2001–2002	70	14	12	0	96 (35)	124	40	15	0	179 (65)	275
2002–2003	85	22	8	1	116 (42)	117	29	11	3	160 (58)	276

TABLE 4F Units 21A and 21E moose hunter residency and success, regulatory years 1986–1987 through 2002–2003

Regulatory year	Successful						Unsuccessful						Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	
1986–1987	43	135	45	15	238	(75)	10	63	7	0	80	(25)	318
1987–1988	21	164	43	29	257	(68)	9	83	20	9	121	(32)	378
1988–1989	13	177	69	58	317	(75)	2	62	28	16	108	(25)	425
1989–1990	19	178	53	28	278	(73)	9	66	18	9	102	(27)	380
1990–1991	40	203	52	15	310	(72)	13	80	25	3	121	(28)	431
1991–1992	41	200	42	4	287	(64)	22	104	34	0	160	(36)	447
1992–1993	20	152	35	19	226	(63)	8	91	26	5	130	(37)	356
1993–1994	39	141	45	14	239	(67)	9	71	36	1	117	(33)	356
1994–1995	35	184	47	17	283	(67)	8	87	43	2	140	(33)	423
1995–1996	40	191	46	2	279	(70)	10	74	31	2	117	(30)	396
1996–1997	42	206	71	2	321	(73)	8	78	31	0	117	(27)	438
1997–1998	33	212	67	11	323	(74)	7	61	41	4	113	(26)	436
1998–1999	39	194	59	14	306	(70)	3	63	62	2	130	(30)	436
1999–2000	44	152	87	15	298	(62)	16	85	82	3	186	(38)	484
2000–2001	39	171	86	8	304	(63)	8	89	78	1	176	(37)	480
2001–2002	32	152	81	7	272	(59)	9	94	84	2	189	(41)	461
2002–2003	38	120	79	2	239	(58)	12	82	80	2	176	(42)	415

TABLE 4G Unit 21A moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful						Unsuccessful						Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	
1994–1995	0	83	39	3	125	(52)	0	76	37	1	114	(48)	239
1995–1996	3	76	36	1	116	(64)	1	37	26	1	65	(36)	181
1996–1997	1	78	51	0	130	(65)	0	45	25	0	70	(35)	200
1997–1998	1	57	50	5	113	(63)	0	36	29	1	66	(37)	179
1998–1999	0	64	39	8	111	(58)	0	30	48	2	80	(42)	191
1999–2000	0	55	67	2	124	(53)	1	47	63	0	111	(47)	235
2000–2001	0	51	51	1	103	(47)	0	52	63	0	115	(53)	218
2001–2002	0	38	55	0	93	(42)	0	59	69	0	128	(58)	221
2002–2003	0	39	43	0	82	(45)	0	47	51	1	99	(55)	181

TABLE 4H Unit 21E moose hunter residency and success, regulatory years 1994–1995 through 2002–2003

Regulatory year	Successful						Unsuccessful						Total hunters
	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	Local resident	Nonlocal resident	Nonresident	Unk	Total	(%)	
1994–1995	40	106	8	7	161	(86)	8	17	1	0	26	(14)	187
1995–1996	34	118	10	1	163	(76)	6	40	5	1	52	(24)	215
1996–1997	31	138	20	2	191	(80)	4	37	6	0	47	(20	238
1997–1998	28	159	17	6	210	(83)	2	30	12	3	47	(17)	257
1998–1999	37	132	20	6	195	(80)	3	33	14	0	50	(20)	245
1999–2000	38	103	20	13	174	(70)	13	40	19	3	75	(30)	249
2000–2001	39	120	35	7	201	(77)	8	37	15	1	61	(23)	262
2001–2002	32	114	26	7	179	(75)	8	36	15	2	61	(25)	240
2002–2003	38	81	36	2	157	(67)	12	35	29	1	77	(33)	234

TABLE 5A Unit 19 moose harvest percent by transport method, regulatory years 1986–1987 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1986–1987	44	<1	44	2	3	<1	1	5	0	446
1987–1988	38	<1	44	3	7	2	<1	5	0	549
1988–1989	45	<1	43	2	5	1	<1	4	0	637
1989–1990	47	<1	41	2	2	<1	<1	5	0	469
1990–1991	53	1	35	2	4	<1	<1	4	0	404
1991–1992	49	<1	41	3	4	<1	<1	1	0	476
1992–1993	41	1	45	2	9	0	<1	2	0	510
1993–1994	57	1	33	3	2	<1	<1	3	0	543
1994–1995	47	<1	38	5	6	<1	<1	3	0	589
1995–1996	50	2	38	6	<1	<1	<1	3	0	535
1996–1997	50	2	39	5	2	<1	<1	<1	0	632
1997–1998	53	2	34	5	5	<1	<1	<1	0	572
1998–1999	50	2	35	7	5	<1	<1	<1	<1	552
1999–2000	51	1	34	8	4	<1	0	1	<1	466
2000–2001	54	1	37	6	1	0	0	<1	<1	480
2001–2002	46	1	41	8	2	<1	<1	1	0	424
2002–2003	44	<1	44	8	2	<1	0	1	0	357

TABLE 5B Unit 19A moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	14	0	65	<1	17	0	<1	3	0	168
1995–1996	17	0	74	<1	2	<1	0	6	0	141
1996–1997	13	0	80	<1	5	<1	0	0	0	184
1997–1998	17	0	64	2	16	0	0	<1	0	142
1998–1999	13	<1	67	1	15	0	1	1	1	146
1999–2000	21	0	59	1	14	0	0	5	<1	118
2000–2001	27	0	70	1	1	0	0	0	1	106
2001–2002	14	1	81	3	1	0	0	0	0	95
2002–2003	28	0	61	6	0	0	0	4	0	67

TABLE 5C Unit 19B moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	79	0	18	0	<1	0	0	2	0	163
1995–1996	85	1	11	2	0	0	1	0	0	136
1996–1997	90	0	8	1	0	0	0	1	0	166
1997–1998	92	0	5	0	1	0	2	0	0	159
1998–1999	90	0	7	1	0	0	1	1	<1	153
1999–2000	88	0	8	3	0	0	0	1	0	112
2000–2001	87	0	12	0	0	0	0	1	0	153
2001–2002	85	0	12	1	0	0	2	0	0	112
2002–2003	84	0	14	2	0	0	0	0	0	81

TABLE 5D Unit 19C moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	74	3	5	15	0	2	0	1	0	152
1995–1996	75	4	3	15	0	<1	2	<1	0	127
1996–1997	76	7	0	16	0	<1	0	<1	0	153
1997–1998	73	8	2	15	<1	1	0	0	0	140
1998–1999	64	6	1	25	2	1	0	1	0	149
1999–2000	70	4	0	24	0	1	0	1	0	131
2000–2001	71	3	1	21	4	0	0	0	0	123
2001–2002	64	5	0	24	5	1	0	1	0	111
2002–2003	65	2	0	23	7	1	0	2	0	85

TABLE 5E Unit 19D moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	9	0	74	4	6	0	3	4	0	106
1995–1996	19	2	67	6	<1	0	2	4	0	112
1996–1997	17	0	71	3	4	1	4	0	0	103
1997–1998	19	0	74	2	1	0	2	2	0	105
1998–1999	20	0	79	0	1	0	0	0	0	86
1999–2000	20	0	78	2	0	0	0	0	0	95
2000–2001	5	0	92	2	0	0	0	1	0	84
2001–2002	14	0	80	3	0	0	0	3	0	96
2002–2003	9	0	88	2	1	0	0	0	0	116

TABLE 5F Units 21A and 21E moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	27	<1	61	1	6	2	0	2	0	286
1995–1996	32	<1	62	<1	3	0	<1	1	0	279
1996–1997	33	0	59	<1	6	<1	0	<1	0	321
1997–1998	29	0	66	<1	3	0	0	<1	0	323
1998–1999	34	0	61	<1	3	0	0	<1	0	306
1999–2000	34	<1	60	<1	4	<1	<1	2	0	298
2000–2001	30	0	65	<1	3	0	<1	2	0	304
2001–2002	38	1	48	0	10	1	1	1	0	272
2002–2003	35	0	54	<1	8	1	1	1	0	239

TABLE 5G Unit 21A moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	57	<1	33	2	<1	5	0	2	0	125
1995–1996	66	0	29	2	0	0	<1	2	0	116
1996–1997	68	0	30	2	0	0	0	<1	0	130
1997–1998	70	0	28	<1	<1	0	0	<1	0	113
1998–1999	69	0	30	0	<1	0	0	0	0	112
1999–2000	70	1	24	1	0	1	1	2	0	124
2000–2001	68	0	28	1	0	0	1	2	0	103
2001–2002	76	0	18	0	1	0	1	3	0	93
2002–2003	71	0	22	1	0	2	2	1	0	82

TABLE 5H Unit 21E moose harvest percent by transport method, regulatory years 1994–1995 through 2002–2003 (successful hunters only)

Regulatory year	Harvest percent by transport method									
	Airplane	Dog Team/ Horse	Boat	3- or 4-Wheeler	Snowmachine	Other ORV	Highway vehicle	Unk	Airboat	Total
1994–1995	4	0	83	<1	10	0	0	2	0	161
1995–1996	8	<1	86	0	4	0	0	1	0	163
1996–1997	10	0	79	<1	9	<1	0	<1	0	191
1997–1998	8	0	87	0	4	0	0	<1	0	210
1998–1999	14	0	79	<1	5	0	0	2	0	195
1999–2000	7	0	85	0	6	0	0	2	0	174
2000–2001	10	0	84	0	4	0	0	2	0	201
2001–2002	18	1	64	0	14	1	1	1	0	179
2002–2003	16	0	71	0	13	0	0	<1	0	157

TABLE 6 Units 19A, 19D, and 21E potlatch moose harvest history, regulatory years 1999–2000 through 2003–2004

Regulatory year	Potlatch harvest					
	Unit 19A		Unit 19D		Unit 21E	
	M	F	M	F	M	F
1999–2000				1		
2000–2001						
2001–2002						
2002–2003	2			1		2
2003–2004						

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO Box 25526
Juneau, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 21B (4871 mi^2)

GEOGRAPHIC DESCRIPTION: Lower Nowitna River, Yukon River between Melozitna and Tozitna Rivers

BACKGROUND

In this portion of Interior Alaska, even the earliest accounts of the area mentioned the presence of moose. Moose had apparently become abundant by the time gold seekers converged on the area in the early 1900s. The village of Ruby had a population of 10,000 people during the 1910 gold rush, and many moose were hunted to supply the townsfolk and miners with meat. The area supported a large moose population from the early 1900s to late 1970s. Several severe winters in the late 1960s and early 1970s initiated widespread declines in moose populations throughout the Interior, including Unit 21B.

Historically, wildfires were a major force affecting the productivity and diversity of moose habitat in this area. Large fires burned a major portion of the area before the 1950s; effective fire suppression substantially altered this fire regime. The 1982 Tanana–Minchumina Fire Plan and more recently the 1998 Alaska Interagency Wildland Fire Management Plan allowed some fires to burn with minimal interference.

The Nowitna River to the east of Ruby is a popular hunting area for residents of Ruby, Tanana, and, to a lesser extent, Galena. It is also a popular hunting area for Fairbanks residents who use boats and aircraft for access. Because of its long history of use by both local and nonlocal hunters, this area was the focus of much of the management effort in Unit 21B over the years.

Aerial moose surveys during 1977–1979 indicated moose numbers were declining in the Nowitna. Wolves were abundant compared to the number of moose available, and predation by wolves was believed responsible for the decline in moose numbers.

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

A moose population survey in 1980, using methods described by Gasaway et al. (1986), estimated 2386 ± 429 moose in a 2774-mi^2 portion of the unit in the lower Nowitna drainage. A 1986 population estimation survey conducted in a 1596-mi^2 portion of the 1980 survey area suggested a reduction in moose numbers in a comparable area (1389 ± 375 in 1980; 878 ± 209 in 1986), but the difference was not significant at the 90% confidence level. A 1990 population estimate conducted in essentially the same area suggested that the population had increased (1560-mi^2; 1214 moose ± 219). However, once again the estimate was not significant statistically. Results of a 1995 population estimation survey in a 1338-mi^2 (1031 moose ± 206) portion of the unit were not significantly different (90% confidence) from those of the 1990 survey. More recently in 2001 a population estimation survey, the first without a sightability correction factor (SCF), indicated the population was not significantly different from the 1995 estimate. However, the 2001 estimate was conducted using different survey techniques and a substantially different statistical analysis.

In addition to the lower portion of the Nowitna drainage, Unit 21B includes the area east of the Ruby–Poorman Road, the banks of the Yukon River from Ruby to Tanana, the Blind River, and the Boney River. These areas produce 36–46% of the reported Unit 21B harvest.

MANAGEMENT DIRECTION

MANAGEMENT GOAL AND OBJECTIVES

Management was directed according to the following goal and objectives during the reporting period.

GOAL 1: Manage Unit 21B moose on a sustained yield basis to provide both hunting and other enjoyment of wildlife in a manner that complements the wild and remote character of the area and that minimizes disruption of local residents' lifestyles.

Objective 1: Provide for harvest not to exceed 150 moose or 5% of the annual moose population estimate.

Objective 2: In combination with Unit 21C, implement at least 2 habitat enhancement activities every 5 years.

> Activity 1: Conduct trend count surveys annually or population estimation surveys when funding is available, and notify relevant wildlife agencies if the population declines below 3000–4000 moose.

METHODS

Established trend count areas were surveyed cooperatively with U.S. Fish and Wildlife Service (FWS) to assess population status and trend. Piper PA-18 (or equivalent) aircraft were used, and contiguous survey units of approximately 12 mi^2 each were searched at a rate of at least 4 min/mi^2 to ensure reasonably high sightability, minimal bias, and data comparability between years. A moose population estimation survey was conducted in November 1995

using a regression survey method developed by ADF&G biometricians that used a probability sample and regression estimator (Särndal et al. 1992).

Moose population estimation surveys conducted over 4754 mi^2 of Unit 21B in 2001 used Geostatistical Spatial Population Estimator (GSPE) techniques without an SCF, although preliminary studies indicate an SCF will eventually need to be applied (Ver Hoef 2001). Survey techniques were modified from those outlined by Gasaway et al. (1986). An important change from the Gasaway methodology was that, instead of geographical land characteristics, a grid system based on latitude and longitude coordinates was used to locate sample units (~5.7 mi^2 in size), with search intensity of ~6 min/mi^2.

We monitored harvest by checking moose harvest reports and operating a moose hunter check station on the Nowitna River.

Survey and harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002–30 Jun 2003).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size and Trend

Using the results of the 1995 population estimation survey and one conducted in 1990, Woolington (1998) estimated there were 2324–3530 moose in the unit. A density of 0.20 moose/mi^2 was applied to the portion of the Little Mud River drainage not included in the population estimation survey, and a density of 0.64 moose/mi^2 was applied to the remainder of the unit that was not surveyed. Higher moose densities exist in favorable habitat along the Nowitna floodplain and immediately adjacent to the Yukon River. Densities are low to moderate away from the river.

Results from the population surveys conducted in November 2001 indicated a total of 3161 moose without an SCF (1828–4493; 90% CI) over 4754 mi^2 of Unit 21B (Table 1). This total was within the range reported for RY97–RY98. Thus, the total moose estimate for this reporting period is unchanged from the previous report, but a higher proportion of the population was calves and yearlings, which have elevated mortality rates compared with adults.

Survey data collected in early winter from established trend count areas (TCA) along the lower Nowitna suggested stable or slightly increasing moose densities during 1991–1998 (Tables 2 and 3). However, surveys conducted from 1999 to 2001 indicated the population was perhaps decreasing when looking at the point estimates for the western portion of Unit 21B. For example, recruitment indicators such as the number of calves per 100 cows began to decline; however, because of inadequate snow coverage, the 1999 results were not reliable.

Population Composition

Composition data were available from aerial surveys we conducted with FWS staff in established TCAs on the Nowitna National Wildlife Refuge (Tables 2–4). Fall 2003 survey results indicated bull:cow ratios along the river decreased from RY01 while calf:cow ratios increased. Yearling bull:100 cow ratios were relatively unchanged empirically, but the decline in the denominator value of the ratio (cows) suggests overwinter survival was still poor. The occurrence of twin calves among moose observed in these early winter surveys has been very poor since the trend areas were established in 1992, particularly at the Nowitna Mouth TCA. The cause of the spike in 2003 is unknown, but was probably a random event.

The 2001 population estimation data indicated the sex and age composition over the entire area was not as depressed as the area along the river. For the entire 2001 survey area the GSPE analysis resulted in the following: the calf:cow ratio was 18.3:100 (7.9–28.8:100; 90% CI), the yearling bull:cow ratio was 9.0:100 (2.5–15.6:100; 90% CI), and the adult bull:cow ratio was 38.2:100 (12.5–63.8:100; 90% CI). However, the Nowitna River Corridor bull:cow ratios continued to be low, and an increasing proportion of the bulls in the RY03 TCA counts were yearling bulls (50% in Nowitna Mouth TCA; 67% in Nowitna–Sulatna Confluence TCA). Although calf and yearling ratios did indicate an improvement in RY03, the observed levels are not high enough to indicate significant population growth.

Distribution and Movements

Based on movements of radiocollared cow-calf pairs, most cows spend their summer months around open grass and shrub meadows on the floodplain, but away from the river (Woolington 1998). In October they move to the riparian areas, where they remain until early May. Relatively few cow moose wintered in the hills to the north and south of the Nowitna River.

MORTALITY

Harvest

Season and Bag Limit.

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 21B, that portion within the Nowitna River drainage.		
RESIDENT HUNTERS: 1 bull.		
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.	5 Sep–25 Sep	5 Sep–20 Sep
Remainder of Unit 21B		

Unit and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
RESIDENT HUNTERS: 1 bull. NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.	5 Sep–25 Sep	5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. In 2002 the board adopted a regulation for all of Unit 21B requiring hunters to leave the meat on the bone of the 4 quarters and the ribs until the meat is transported from the field. At the 2004 board meeting, regulations were adopted to eliminate the general harvest permit and implement a resident registration hunt that requires the destruction of trophy value. Additionally, a drawing permit was implemented for resident and nonresident hunters for the entire unit. Through the discretionary authority of the department, 3 separate drawing permit areas were designated which included a 10-mile corridor on the Nowitna River as one permit area, and the lands east and west of the corridor as the other 2 permit areas.

Harvest. Reported harvest for the unit averaged 60 (range = 52–69) moose annually during RY97–RY03 (Table 5). In addition, the Unit 21B unreported harvest was estimated at 5 moose per year for Ruby residents, and 15 moose per year for Tanana residents. The Nowitna drainage produced 59–93% ($\bar{x}$ = 77%) of the unit's reported harvest during RY97–RY01 (Tables 6 and 7).

To estimate the unreported harvest of 20 moose, we examined the Division of Subsistence's estimated RY99 harvest by residents of Unit 21B (47 moose, Anderson et al. 2001). The estimated unreported harvest (Table 5) incorporated this moose harvest data for Ruby and Tanana (approximately 36 moose annually; 3 year $\bar{x}$), less the reported harvest by those same villages (approximately 15 moose annually). Because subsistence harvest remained relatively constant among years, we applied the difference of approximately 20 unreported moose to the reported harvest during RY01–RY03.

Checkstation Results. Since RY88 a moose hunter checkstation has been located at the mouth of the Nowitna River. During RY96–RY97 the checkstation was mandatory because it was the only place Nowitna River registration hunt permits were available. Except for RY97, hunter numbers and success rate of hunters passing through the Nowitna checkstation was relatively constant; however, the 3-year mean number of hunters had increased from $\bar{x}$ = 132 during RY94–RY96 up to $\bar{x}$ = 167 during RY01–RY03 (Table 6). It is unclear why there was a brief decline in the number of hunters in RY97.

Hunter Residency and Success. Based on harvest reports, the majority of Unit 21B hunters were Alaska residents who resided outside the unit, particularly Fairbanks (Table 7). Average success rate for all hunters during RY99–RY03 was 40.8% (range = 36–43%), slightly less than the average during RY97–RY01 (43.6%).

Harvest Chronology. During RY99–RY00 hunter reports indicated that most moose were shot in the last half of the September season (Table 8). This was probably due to relatively little movement of bulls in the earlier part of the season compared to the later part of the season.

Harvest was not reported for the winter months, but it was probably close to 20% of the annual kill. Winter harvest likely occurred during October–March (Anderson et al. 2001).

Transportation Methods. Not surprisingly, the majority of hunters used boats to hunt moose (Table 9). It is undetermined why a relatively large proportion of transportation methods were unknown in RY98 (33%), but I do not believe any significant changes in the mode of transportation occurred. Snowmachines were used during the winter, but winter reporting rates were low because there was no announced season, and therefore snowmachine use was underrepresented.

Other Mortality

Predation mortality on moose calves is significant in the unit (Osborne et al. 1991). During calf mortality studies of radiocollared newborn moose, black bears were the main predator, killing 38% of all calves. Wolves killed 11% of all calves, unidentified predators killed 8%, grizzly bears killed 2%, and 5% died from other natural causes. A single pack of 25 wolves was observed during the fall 1999 moose trend count survey at the mouth of the Nowitna. A reconnaissance survey flown in spring 2001 indicated wolf numbers were stable (ADF&G files, Galena). A sample unit probability estimator survey (SUPE; Becker et. al. 1998) flown in spring 2004 by the FWS indicated the wolf population estimate was similar to the previous estimate (B. Scotton, FWS, personal communication).

HABITAT

Assessment

No new data were collected on habitat conditions during this reporting period. Observations indicated browse availability was not limiting the moose population. Regeneration from a fire that burned in 1986 east of the Nowitna River in the Little Mud River drainage provided excellent moose browse. During November 1995 surveys, this area was classified as high moose density. Several adjacent sample units were classed as medium. There is a dense stand of black spruce between the 1986 burn and the Nowitna River that should be considered for a prescription burn.

CONCLUSIONS AND RECOMMENDATIONS

Density data from 1991–2001 fall surveys of permanent trend count areas was greatly variable from year to year and did not provide a clear picture of what the population trend may be. However, classification data showed the number of calves declined in 2000 and 2001. Although yearling bull:100 cow ratios appeared to be stable, the low number of cows

counted heavily influenced data over the last 4 years. Bull:cow ratios were low for the last several years in both TCAs along the heavily hunted portion of the Nowitna River. Away from the river the bull:cow ratio was slightly higher. But the high proportion of yearlings that made up the bull component of the count was a biological concern. The low bull:cow ratios were instrumental in the board action to implement a drawing permit hunt on the Nowitna corridor, with the understanding that the department would issue permits to achieve at least a 50% reduction in the harvest of bulls within the corridor.

Population estimation surveys conducted in 2001 (without an SCF) indicated no clear change in population trend for all of Unit 21B since 1990. However, in the western half of the unit, point estimates for the moose numbers appeared to have declined in 1995 and again in 2001. The comparison between those years is confounded by differences in the size of the area, the statistical analysis used, and survey techniques. Based on the RY01 population survey, the current estimate for the entire unit is 3160 moose (1828–4494; 90% CI; without an SCF), which is within the range of the management objective. Preliminary data collected in other areas of the Interior suggests a sightability correction factor of 1.12 may be appropriate. The management goal was met during RY01–RY02. The moose population continued to support the consumptive demands as well as the nonconsumptive uses identified.

We also met the harvest objective. Total estimated harvest ranged from 78 to 88 moose during the reporting period, less than 3% of the total Unit 21B estimated population for RY01–RY03. For the next reporting period, that objective will be changed to read, "*Objective 1:* Provide for harvest not to exceed 150 moose or 5% of the annual moose population estimate, whichever is less."

The objective to implement habitat enhancement projects was limited to review of fire management plans and fire suppression policies. I recommend a prescribed burn in the upland area east of the Nowitna floodplain and north of the Little Mud River to Bering Creek. This area is adjacent to several old burns that are reaching peak browse production. The area west of the Nowitna in the upper Big Creek drainage is also dominated by late seral spruce and birch and should be allowed to burn to enhance potential moose habitat.

Predators remained abundant and continued to be the primary factor limiting moose abundance in the area. Harvest of wolves within the unit was low, and few black bears were harvested. The moose calf mortality study conducted in the late 1980s indicated black bears were the major predator of moose calves (Osborne et al. 1991). Efforts should be made to increase the harvest of predators if more moose are desired.

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TABLE 1 Unit 21B Lower Nowitna River moose population estimates, regulatory years 1980–1981 through 2001–2002

Regulatory year/Area	Area mi^2	Population	90% CI[a]	Bulls:100 Cows	Calves:100 Cows	Yrlg Bulls:100 Cows	Density
1980–1981/West[b]	1556	1389	27	41[c]	34[c]	13[c]	0.89
1986–1987/West[b]	1596	878	24	34[c]	40[c]	6[c]	0.55
1990–1991/West[b]	1560	1214	18	39.9	39.1	9.9	0.78
1995–1996/West[d]	1338	1031	20	33.8	30.1	14.5	0.77
2001–2002/West[e]	1531	759	19.6	25.8	19.4	7.2	0.50
2001–2002/Total[e]	4754	3161	42.2	38.2	18.3	9.0	0.67

[a] Confidence interval (% ±).
[b] Moosepop analysis
[c] Ratios calculated from observed values
[d] Moosepop analysis of Regression Survey
[e] GSPE analysis w/o SCF

TABLE 2 Unit 21B Nowitna/Sulatna confluence (75.5 mi^2) aerial moose composition counts, regulatory years 1991–1992 through 2003–2004[a]

Regulatory year	Bulls:100 cows	Yrlg bulls: 100 cows	Calves:100 cows	Twins:100 cows	Percent calves	Moose	Moose/mi^2
1991–1992	21	9	29	8	20	200	2.7
1992–1993	18	1	48	7	29	171	2.3
1993–1994	22	7	20	0	14	195	2.6
1994–1995	16	6	20	4	15	191	2.5
1995–1996	15	4	33	6	22	148	2.0
1996–1997	18	8	23	6	13	216	2.9
1998–1999	19	2	28	6	19	180	2.5
1999–2000[b]	6	1	23	12	18	106	1.5
2000–2001	30	6	7	0	5	185	2.5
2001–2002	19	9	13	0	10	137	1.8
2003–2004	17	11	27	7	19	153	2.0

[a] U.S. Fish and Wildlife Service.
[b] Poor snow conditions during survey

TABLE 3 Unit 21B Nowitna mouth (59 mi^2) aerial moose composition counts, regulatory years 1992–1993 through 2003–2004[a]

Regulatory year	Bulls:100 cows	Yrlg bulls:100 cows	Calves:100 cows	Twins:100 cows	Percent calves	Moose	Moose/mi^2
1992–1993	21	0	31	0	20	138	2.9
1993–1994	32	6	32	6	20	189	3.2
1994–1995	19	8	23	0	22	148	2.5
1995–1996	16	5	26	0	18	116	2.0
1996–1997	21	7	22	0	16	185	3.1
1998–1999	20	3	12	0	9	182	3.0
1999–2000[b]	11	8	21	0	16	87	1.4
2000–2001	22	4	8	0	7	170	2.9
2001–2002	13	6	28	2	20	154	2.6
2003–2004	13	6	45	18	28	172	2.9

[a] U.S. Fish and Wildlife Service.

[b] Poor snow conditions during survey

TABLE 4 Unit 21B Deep Creek (52.5 mi^2) aerial moose composition counts, regulatory years 1982–1983 through 2001–2002[a]

Regulatory year	Bulls:100 cows	Yrlg bulls:100 cows	Calves:100 cows	Twins:100 cows	Percent calves	Moose	Moose/mi^2
1982–1983	90	35	42	0	18	72	1.4
1987–1988	43	7	55	14	27	87	1.7
1993–1994	45	15	20	0	12	66	1.3
1995–1996	48	8	30	8	17	89	1.7
1996–1997	29	5	24	0	16	89	1.7
2001–2002	31	10	18	0	12	73	1.4

[a] U.S. Fish and Wildlife Service.

TABLE 5 Unit 21B moose harvest, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest by hunters				Unreported	Total
	Bull	Cow	Unk	Total		
1990–1991	81	0	0	81	15	96
1991–1992	65	0	0	65	15	80
1992–1993	46	0	0	46	15	61
1993–1994	71	1	0	72	15	87
1994–1995	63	0	0	63	15	78
1995–1996	66	0	0	66	15	81
1996–1997	63	0	0	63	15	78
1997–1998	58	1	0	59	15	74
1998–1999	53	2	2	57	15	72
1999–2000	69	0	0	69	20	89
2000–2001	49	1	2	52	20	72
2001–2002	56	0	2	58	20	78
2002–2003	68	0	0	68	20	88
2003–2004[a]	60	0	0	60	20	80

[a] Preliminary results.

TABLE 6 Unit 21B Nowitna River checkstation hunters (R), harvest (H) and success (S%), regulatory years 1990–1991 through 2003–2004[a]

Regulatory	Local villages[b]			Fairbanks			Other residents			Nonresident			Total		
year	R	H	S%	R	H	S%	R	H	S%	R	H	S%	R	H	S%
1990–1991	23	7	30	67	32	48	26	12	46	14	4	29	130	55	42
1991–1992	21	9	43	72	24	33	44	11	25	17	2	12	154	46	30
1992–1993	24	3	12	38	19	50	53	10	19	10	2	20	125	34	27
1993–1994	19	7	37	58	26	45	35	19	54	20	1	5	133	53	40
1994–1995	16	6	37	63	27	43	41	16	39	13	5	38	134	54	40
1995–1996	16	3	19	63	24	38	44	9	20	9	2	22	132	38	29
1996–1997	19	2	11	54	21	39	36	12	33	20	2	10	129	37	29
1997–1998	16	1	6	57	29	51	21	8	38	7	3	43	101	41	41
1998–1999	17	4	24	57	26	46	27	17	63	22	3	14	123	50	41
1999–2000	24	3	13	57	21	37	60	17	28	14	4	29	155	45	29
2000–2001	11	2	18	59	21	36	56	18	32	28	6	21	154	47	31
2001–2002	27	0	0	62	21	34	48	8	17	23	5	22	160	34	21
2002–2003	18	3	17	56	25	45	45	20	44	15	3	20	134	51	38
2003–2004	22	4	18	80	29	36	80	19	24	26	4	15	208	56	27

[a] U.S. Fish and Wildlife Service.
[b] Tanana, Ruby, and Galena.

TABLE 7 Unit 21B moose hunter residency and success, regulatory years 1990–1991 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	Local resident[a]	Nonlocal Resident	Nonresident	Unk	Total	
1990–1991	22	48	8	3	81	10	41	1	1	53	134
1991–1992	21	34	8	2	65	21	56	8	1	86	151
1992–1993	12	31	2	1	46	24	55	10	1	90	136
1993–1994	23	45	3	1	72	7	47	11	0	65	137
1994–1995	12	44	5	2	63	7	44	2	0	53	116
1995–1996	15	43	8	0	66	11	60	6	0	77	143
1996–1997	16	44	3	0	63	38	68	17	0	123	186
1997–1998	9	46	4	0	59	27	73	8	0	108	167
1998–1999	7	46	3	1	57	10	24	4	0	38	95
1999–2000	13	49	6	1	69	10	66	11	3	90	159
2000–2001	9	30	12	1	52	3	48	17	0	68	120
2001–2002	14	33	10	1	58	19	57	16	0	92	150
2002–2003	8	52	8	0	68	10	67	12	0	89	157
2003–2004[b]	11	38	7	4	60	14	75	12	5	106	166

[a] Tanana, Ruby, and Galena.
[b] Preliminary results.

TABLE 8 Unit 21B moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2003–2004

Regulatory year	Harvest chronology percent by month/day		
	9/1–9/14	9/15–9/25	*n*
1996–1997	42	58	59
1997–1998	31	69	55
1998–1999	39	61	49
1999–2000	37	63	68
2000–2001	37	63	49
2001–2002	25	75	55
2002–2003	26	74	66
2003–2004[a]	32	68	60

[a] Preliminary results.

TABLE 9 Unit 21B moose harvest percent by transport method, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	ORV	Highway vehicle	Unk	*n*
1990–1991	11	1	78	0	0	2	6	1	81
1991–1992	9	1	75	0	0	0	10	4	65
1992–1993	10	0	76	1	0	0	8	4	46
1993–1994	9	0	82	3	1	0	3	1	72
1994–1995	21	0	69	2	0	0	6	3	63
1995–1996	12	0	79	3	0	0	4	1	66
1996–1997	4	0	92	2	0	0	0	2	63
1997–1998	5	0	88	0	0	0	5	5	59
1998–1999	4	0	60	0	0	0	4	33	57
1999–2000	7	1	78	0	0	1	9	3	69
2000–2001	31	0	67	0	0	0	0	0	52
2001–2002	14	0	67	0	2	0	14	3	58
2002–2003	16	0	81	0	0	0	1	1	68
2003–2004[a]	15	0	77	0	2	0	7	0	60

[a] Preliminary results.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 21C (3671 mi^2)

GEOGRAPHIC DESCRIPTION: Dulbi River above Cottonwood Creek and Melozitna River above Grayling Creek

BACKGROUND

Moose have been present in Unit 21C throughout the recent history of Interior Alaska (S. Huntington, personal communication). Moose densities are low presumably due largely to predation by bears and wolves, (Gasaway et al. 1992), and population trends are unknown. Access into the unit is limited and is mostly by aircraft. Thus, hunter numbers and harvest have been low and probably do not adversely impact the moose population. Because of low harvest, there has been little need to extensively monitor the moose population in this area.

Terrain in the unit is hilly and mountainous, with peaks as high as 5000 feet. Corridors along 2 large rivers, the Melozitna and the Dulbi, represent the main summer habitat. Numerous fires have resulted in large expanses of potentially good winter habitat, particularly north of the Melozitna River.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.
- Provide a sustained opportunity to participate in hunting moose.

MANAGEMENT OBJECTIVE

- Maintain a harvest of bulls that is ≤6% of the estimated population.

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

METHODS

POPULATION STATUS AND TREND

We conducted a moose stratification survey on 18 and 19 April 2000 using the Geostatistical Population Estimator (GSPE), a modification of the "Gasaway" technique (Gasaway et al. 1986) using spatial statistics (Ver Hoef 2001). The stratification provided the basis for a rough population estimate of the unit and will be used to conduct population estimation surveys in the future. We conducted the stratification survey in a Cessna 206 flown at 95–120 mph at altitudes of 500–1000 ft above ground, with 2 observers in the back seat and 1 observer-recorder in the front seat. Prior to the flight, we divided Unit 21C into a grid of 658 sample units (3671 mi^2) that were approximately 5.5 mi^2. We flew on the north-south boundary between 2 sample units, and each sample unit was classified as low or high moose density, based on number of moose observed, number of tracks observed, and habitat. If moose were spotted in the sample unit during the flight, it was designated a high moose density unit. Alternatively, if no moose were observed, it was typically designated a low moose density unless it was judged to be good habitat and >5 sets of tracks were observed. We surveyed 438 sample units (1971 mi^2). The area not surveyed was primarily high mountainous terrain in the Kokrine Hills. It will be stratified based on known habitat type and type of habitat estimated from a topographic map. Sex and age of moose were not recorded. No other surveys were completed in Unit 21C.

HARVEST

We monitored harvest and hunting pressure using mandatory harvest reports submitted by hunters. Reminder letters were sent to increase response rates of harvest reports. We summarized total harvest, antler size of harvested moose, hunter residency and success rate, the chronology of harvest, and transportation used to hunt. Each of these parameters were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY02 = 1 Jul 2002–30 Jun 2003).

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

No surveys were completed in Unit 21C during this reporting period. However, elsewhere where moose live with lightly harvested bears and wolves, low-density moose populations have remained at low levels since density estimates were first flown in the late 1970s (Gasaway et al. 1992, ADF&G files).

Survey conditions for the April 2000 stratification were only fair because hilly and mountainous terrain and bright light adversely affected sightability of moose. However, conditions were not poor because the bright light was an advantage for locating fresh tracks, which was a stratification criterion. Because moose distribution may be dependent on seasonal influences, this stratification will apply best to a spring survey.

During the 2000 survey, 39 sample units were identified as high density and 399 as low density from a total of 438 sample units. Moose were concentrated on the north side of the Melozitna River on the hills that divide the drainages of the Melozitna and Dulbi Rivers. Additional moose and tracks were observed on the western end of the unit within the Dulbi River drainage as we approached the Koyukuk River. However, only 31 moose were observed during the survey. This was lower than expected for the area and was likely a result of reduced sightability in spring (Gasaway et al. 1986).

Estimated moose density was 0.35–0.45/mi^2 (1284–1651 moose) using the results of the April 2000 survey and by comparing similar habitat to known densities elsewhere in the state where bears and wolves are lightly harvested (Gasaway et al. 1992). This density is lower than previously estimated (0.5–1.0 moose/mi^2; Osborne 1996).

Population Composition

Population composition data in Units 21C was limited to the percentage of large bulls (antlers wider than 50 inches) in the harvest. If harvest rates of bulls were high, the percentage of large bulls in the harvest would decline within a few years. Instead, the percentage of large bulls in the reported harvest ranged from 61 to 84% during the past 7 years (RY97–RY03). These data suggest there was no danger of overharvest of bulls in these units.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 21C. RESIDENT AND NONRESIDENT HUNTERS: 1 bull.	5 Sep–25 Sep	5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. During the March 2002 Board of Game meeting, a regulation was adopted that requires hunters to keep the meat on the bone of the 4 quarters and ribs until they remove the harvested moose from the field. During the March 2004 Board of Game meeting (after this report period), a regulation was adopted that established a drawing permit hunt and a resident registration permit hunt for the Dulbi River portion of Unit 21C. The board also adopted a regulation that allows nonresident hunters throughout the unit to only shoot bulls with 50-inch antlers or antlers with 4 or more brow tines on 1 side.

Hunter Harvest. Harvest was relatively stable with a mean kill of 27 ± 6.8 ($\bar{x}$ ± 1*s*) moose annually for the past 10 years (RY94–RY03; Table 1). Two years that differed significantly from the mean were RY96, when only 15 moose were harvested, and RY97, when 41 moose were harvested. In RY01, RY02 and RY03, 30, 31 and 21 moose were harvested, respectively; however the RY03 data is still preliminary. For the 10-year period (RY94–

RY03), the number of hunters averaged 46.9 ± 9.6 ($\bar{x}$ ± 1*s*) with a range of 27–61. Annual harvest during RY01–RY02 was <5% of the estimated number of moose in the unit.

Hunter Residency and Success. During the report period (RY01–RY02), no one lived within the unit; however, residents from Ruby in adjacent Unit 21B occasionally hunted the Melozitna River. Nonresidents composed an average of 46% ± 11% ($\bar{x}$ ± 1*s*) of the hunters during RY90–RY01. Nonresident hunters increased to 49% in RY01–RY03, which was the fifth consecutive 3-year period above the 10-year average (Table 1). Percent success was >58% for RY94–RY03, except in RY03 when success was 46%. Relatively high success rates were probably due to relatively low hunter numbers and concentrations of moose along the river corridors in September; however, RY03 was the fourth consecutive year hunter success declined.

Harvest Chronology. Moose were harvested throughout the season, but the highest percent of harvest occurred during mid September (Table 2).

Transport Methods. Hunters mainly used aircraft for transport (Table 3). A waterfall near the mouth of the Melozitna River restricts travel up the river and extensive sandbars often impede boat access into the upper Dulbi River at the low water levels common during the fall.

Other Mortality

Wolves and grizzly and black bears live throughout the unit. In 1995 Osborne (1996) estimated a minimum of 60 wolves in the unit and a grizzly bear density of 1/40 mi^2. Numbers of wolves and black bears have increased in adjacent Units 21D and 24 and have probably increased in Unit 21C. Predation probably influenced moose population status in the past and may be increasing (Gasaway et al. 1992). Wolf and bear harvests were low (<10 annually) because hunter access is limited.

CONCLUSIONS AND RECOMMENDATIONS

Moose density in Unit 21C was estimated at 0.35–0.45 moose/mi^2 with an estimated 1284–1651 moose present in the unit. This estimate did not change from the previous report. Human use of the moose population was low, and recent harvest could be sustained even if the population experienced a reduction. However, recent declines in hunter success indicated that moose numbers along the river corridor might be exhibiting the first signs of approaching maximum desirable levels. Therefore, ADF&G supported changes that restricted nonresidents to harvest large bulls and implemented registration and drawing permit hunts on the Dulbi River drainage portion of Unit 21C.

We achieved our first management goal to protect, maintain, and enhance the moose population and its habitat by monitoring moose harvest pressure, by maintaining open seasons for bear and wolf hunting and trapping, and by encouraging the Department of Natural Resources/Division of Forestry to let wildfires burn. We achieved our second goal to provide a sustained opportunity to participate in hunting moose by maintaining long hunting seasons. In addition, we achieved the management objective to maintain a harvest of bulls that is ≤6% of the estimated population. We estimated the harvest rate to be less than 2% annually.

Although harvest has remained low, we recommend obtaining a population estimate and/or a bull:cow ratio to more closely monitor effects of harvest on the population.

In the next reporting period, the management objective will be changed to the following: Maintain ≥ 20% large bulls in the harvest.

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TABLE 1 Unit 21C moose hunter residency and success, regulatory years 1990–1991 through 2003–2004

Regulatory year	Successful						Unsuccessful						Total hunters
	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total	(%)	Local resident[a]	Nonlocal resident	Nonresident	Unk	Total		
1990–1991	1	18	5	1	25	(67)	0	9	3	0	12		37
1991–1992	0	15	5	0	20	(50)	0	17	3	0	20		40
1992–1993	0	7	2	0	9	(29)	0	15	7	0	22		31
1993–1994	0	11	9	0	20	(51)	0	13	6	0	19		39
1994–1995	0	17	10	0	27	(57)	4	14	2	0	20		47
1995–1996	0	12	13	0	25	(61)	0	13	3	0	16		41
1996–1997	0	10	5	0	15	(56)	0	9	3	0	12		27
1997–1998	1	14	26	0	41	(76)	0	10	3	0	13		54
1998–1999	1	8	12	0	21	(58)	0	9	6	0	15		36
1999–2000	0	15	16	0	31	(63)	0	13	5	0	18		49
2000–2001	0	11	20	0	31	(61)	0	13	7	0	20		51
2001–2002	0	13	17	0	30	(53)	0	16	11	0	27		57
2002–2003	0	10	20	1	31	(51)	0	18	11	1	30		61
2003–2004[b]	0	5	16	0	21	(46)	0	19	6	0	25		46

[a] Local resident resides in Units 21C or 21B.

[b] Preliminary data.

TABLE 2 Unit 21C moose harvest chronology percent by month/day, regulatory years 1995–1996 through 2003–2004

Regulatory year	Harvest chronology percent by month/day				
	9/5–9/10	9/11–9/15	9/16–9/20	9/21–9/25	*n*
1995–1996	29	33	25	12	24
1996–1997	7	33	40	20	15
1997–1998	12	36	34	17	41
1998–1999	25	35	30	10	20
1999–2000	20	30	27	23	30
2000–2001	21	25	50	4	24
2001–2002	15	22	30	33	27
2002–2003	7	21	43	29	28
2003–2004[a]	19	14	43	24	21

[a] Preliminary data.

TABLE 3 Unit 21C moose harvest percent by transport method, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest percent by transport method							
	Airplane	Horse	Boat[a]	3- or 4-wheeler	Snowmachine	ORV	Unknown	*n*
1990–1991	90	0	10	0	0	0	0	21
1991–1992	83	0	4	0	0	0	13	23
1992–1993	89	0	11	0	0	0	0	9
1993–1994	70	10	20	0	0	0	0	20
1994–1995	89	0	11	0	0	0	0	27
1995–1996	84	0	4	0	0	0	12	25
1996–1997	93	7	0	0	0	0	0	15
1997–1998	85	0	10	0	0	0	5	41
1998–1999	90	0	10	0	0	0	0	21
1999–2000	74	0	23	3	0	0	0	31
2000–2001	60	0	40	0	0	0	0	25
2001–2002	60	0	37	0	0	3	0	30
2002–2003	71	0	29	0	0	0	0	31
2003–2004[b]	76	0	14	0	0	0	10	21

[a] Includes airboats.
[b] Preliminary data.

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 21D (12,113 mi^2)

GEOGRAPHIC DESCRIPTION: Yukon River from Blackburn to Ruby and Koyukuk River drainage below Dulbi Slough

BACKGROUND

Moose are abundant in much of Unit 21D. However, high densities are a relatively new occurrence. Local residents first reported seeing occasional moose tracks during winters in the 1930s. During the 1940s and early 1950s, numbers of moose and wolves slowly increased (Huntington 1993). During the 1950s, federal wolf control and aerial shooting reduced the wolf population, allowing a rapid expansion of the moose population during the late 1950s and on through the 1960s. Expansion may have begun slowing in 1959 when statehood brought an end to federal wolf control. The moose population reached peak numbers about 1970 (S. Huntington, personal communication to T. Osborne, ADF&G) and then stabilized or declined slightly in localized areas in response to increased predation and hunting pressure. Increased predation may have been related to passage of the Federal Airborne Hunting Act in 1972, which halted aerial shooting of predators.

Moose trend count areas (TCAs) established in 1981 in the Lower Koyukuk and Yukon Rivers floodplain areas indicated generally increasing moose densities through about 1993 (Tables 1–8). Initially, we thought this increase was due to better surveys, but a population estimation survey of the Kaiyuh Flats and the lower Koyukuk River in 1987 supported data from the TCAs (Osborne 1996). Moose densities were high along the Yukon River floodplain (3–6 moose/mi^2) and were very high on the Koyukuk River in the Three Day Slough TCA, where densities reached 13.3 moose/mi^2 in early winter 1993. We estimated that 6340 moose inhabited the survey area, and extrapolation of the data suggested a unitwide population of 9000–10,000 in 1993.

Results from a survey in fall 1997 in the lower Koyukuk drainage and the Kaiyuh Flats indicated moose numbers were similar to the 1993 estimate (Huntington 1998). However,

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

declining recruitment parameters observed in the TCAs since 1997 and a population estimation survey conducted in 2001 indicated the population had declined to 8500–9500 moose by winter 2001–2002. Our population estimate did not change substantially by winter 2003–2004 except that yearlings and calves made up a larger proportion of the population, with fewer adult bulls and cows.

There are 4 villages within Unit 21D (Kaltag, Nulato, Koyukuk, and Galena), and the residents of each village have traditional hunting areas. However, Galena residents tend to travel farther afield in the direction of the Koyukuk River. Nonresidents and Alaskans residing outside Unit 21D primarily hunt the Koyukuk River between the Kateel River and the Dulbi Slough. Hunting pressure appears to be gradually shifting farther upriver as hunters from outside the unit learn to deal with the logistics of accessing the area. In 1979 the Koyukuk Controlled Use Area (KCUA) was established in an attempt to reduce participation of nonlocal hunters by prohibiting the use of aircraft. However, by 1986 the hunters arriving by boat from outside the unit equaled the number of hunters who previously accessed the area by aircraft.

Reported harvest prior to 1981 was largely inaccurate because many local residents either did not obtain licenses or failed to report. In 1981 a program was initiated that made it easier for residents of the area to obtain hunting licenses and harvest reports. Educational and enforcement efforts improved the reporting rate by local residents, but at least 25% of the harvest is still unreported.

A hunter checkstation has been operating on the Koyukuk River since 1983. In 1990 the Ella's cabin checkstation on the Koyukuk River became a mandatory stop for all hunters. The checkstation enables accurate determination of the number of hunters using the river to access the KCUA within Unit 21D. It is also used to educate local residents concerning licensing and reporting requirements and to inform nonlocal hunters about regulations specific to the area and about the locations of private property near the river.

The fall hunting season dates changed several times between 1975 and 1981. From 1981 through 1996 there was a 21-day fall season for the entire unit. Harvest of cows was allowed during the last 5 days. A 10-day season in early March also provided hunting opportunity for Alaska residents. In 1991 nonresidents were restricted to bulls with an antler spread of ≥50-inches, or at least 3 brow tines on 1 side. In 1992 the minimum number of brow tines on 1 side was increased to 4. Also beginning in 1992, meat of the hindquarters, forequarters, and ribs of any moose taken in the KCUA had to remain on the bone. In 1996, due to increasing moose hunter numbers and moose harvest, subsistence and general registration hunts were established for the KCUA, downstream from Huslia. In 2000, 2 resident and 2 nonresident drawing hunts replaced the general registration hunt, and the subsistence registration hunt was shifted to open 5 days earlier.

MANAGEMENT DIRECTION

MANAGEMENT GOALS AND OBJECTIVES

Koyukuk River Drainage

Management was directed according to the following management goals and objectives during the reporting period.

GOAL 1: Manage Koyukuk River drainage moose on a sustained yield basis to provide both hunting and other enjoyment of wildlife in a manner that complements the wild and remote character of the area and minimizes disruption of local residents' lifestyles.

Objective 1: Maintain a moose population of 9000–10,000.

Activity 1: Conduct trend count surveys annually or population estimation surveys when funding is available.

Objective 2: Provide for a harvest of moose not to exceed 700 moose or 7% of the annual moose population estimate each regulatory year.

Activity 1: Monitor hunter use levels in the Koyukuk River drainage.

Activity 2: Monitor impacts (social and environmental) to private property and local residents by Koyukuk River moose hunters.

Activity 3: Develop programs to improve population and harvest data for moose in Unit 21D.

Objective 3: Provide for moose hunting opportunity not to exceed 950 hunters per regulatory year.

GOAL 2: Protect and enhance moose habitat.

Objective 1: In combination with Unit 24, implement at least 2 habitat enhancement activities every 5 years.

GOAL 3: Reduce meat spoilage by hunters.

Objective 1: Reduce the amount of spoiled meat observed at Ella's cabin and at hunting camps by 10% each regulatory year.

Activity 1: Implement a program at Ella's cabin checkstation to monitor percentage of meat lost due to spoilage.

GOAL 4: Maintain opportunities for wildlife viewing, photography and other nonconsumptive uses of wildlife within the Koyukuk River drainage.

Objective 1: Increase the number of people engaging in nonconsumptive uses of wildlife by >1% each regulatory year.

Activity 1: Implement a program to monitor long-term trends and establish a baseline of the current level of nonconsumptive use through collaboration with the Koyukuk–Nowitna National Wildlife Refuge and commercial operations in Unit 21D.

METHODS

Previously established TCAs, of 4–6 contiguous "Gasaway" sample units, were surveyed from small fixed-wing aircraft (PA-18 or similar aircraft) to assess moose population parameters (Gasaway et al. 1986). Surveys were flown at an altitude of approximately 500 feet and at ground speeds of 70–80 mi/hr. Moose were classified as cows, calves, yearling bull (<30" antler spread and no brow tine definition), medium bull (30" to 49" antler width), or large bull (≥50" antler width). Sample units of approximately 12 mi^2 each were searched at a rate of approximately 5 min/mi^2 to ensure reasonably high sightability (approximately 85%), minimal bias, and data comparability among years. Data were recorded on standard data forms and moose locations were also recorded on 1:63,000 U.S. Geological Survey quadrangle maps and as global positioning system (GPS) waypoints. Surveys were not conducted until a minimum snow cover of approximately 12 inches had accumulated. This level of snow cover is important because snow depth influences both sightability and moose distribution.

A population estimation survey was conducted in October and November 2001 and 2002 using similar techniques described by Gasaway et al. (1986) but modified for analysis using the Geostatistical Spatial Population Estimator (GSPE; Ver Hoef 2001). Sample units averaged 5.6 mi^2 in size, with search intensity of ~6 min/mi^2. Sample units were located by latitude–longitude coordinates using in-flight GPS units. Of the 975 sample units in the survey area, 291 sample units were surveyed intensively with an average survey time of 30.8 minutes per 5.6 mi^2 sample unit. Nine hundred seventy-five sample units were stratified in advance of the intensive survey; 255 of the sample units were classified as high moose density and the remaining 720 sample units were classified as low moose density (Bryant and Stout 2003).

Twinning surveys were flown in May to determine the proportion of moose calf twins in the TCA. Search and survey techniques and sample units were similar to those used in early winter. Observation of 50 cows with calves was the desired minimum, but funding and weather often prevented us from achieving that goal. Moose were classified as bull, yearling, calf, cow, cow with 1 calf, or cow with 2 calves. The timing of the surveys was critical. The surveys were flown when approximately 50% of the cows observed had calves. We flew at this time to avoid early mortality factors such as black bear predation, which could strongly influence the results.

Hunting mortality and harvest distribution was monitored through the statewide harvest ticket system, registration permits, drawing permits, door-to-door subsistence surveys, and a hunter checkstation. General season hunters received 1 reminder letter to report harvest. Hunters

with registration, drawing, or Tier II permits received 1 postcard reminder, a telephone call, and a certified letter. Report and survey information obtained was used to determine total harvest, harvest location, hunter residency and success, harvest chronology, and transportation used. Data collected at the checkstation included hunter residency, harvest chronology, time in the field, hunting party size, sex and age structure of harvest (tooth extraction), antler size, method of harvest, location of harvest, caliber of firearm, and method of transportation. Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY01 = 1 Jul 2001 through 30 Jun 2002).

We also evaluated meat care at the checkstation by ranking the level of dryness, cleanliness, smell, overall care, and days in the field. Rankings were subjectively scored on a scale of 1–5, with a score of 1 being a low performance score. Every moose checked at Ella's cabin was evaluated. Hunters coming through the checkstation were also given a wildlife viewing survey card that consisted of 8 brief questions about wildlife observed during their days in the field. Typically, one person per boat was given the voluntary questionnaire. Meat evaluation and wildlife viewing surveys were conducted to evaluate Goals 3 and 4.

We evaluated predation by interviewing trappers, by field observations, and through aerial wolf surveys flown in cooperation with the U.S. Fish and Wildlife Service (FWS).

Vegetation surveys were conducted in spring 2002 in the Lower Koyukuk River drainage. Several browse communities were evaluated to determine species that occur, vigor of the stand, current annual production and the amount of browsing that plants had incurred (C.T. Seaton, ADF&G, personal communication).

We continued with the planning process during this reporting period to address concerns related to the continued increase of hunters in the Koyukuk River drainage. The planning process was initiated in winter 1999, and a Koyukuk River Moose Hunter's Working Group (KWG) was formed from members of the state's advisory committees, the federal Western Interior Subsistence Council, and a local guide representative. The planning group developed a draft 5-year Koyukuk River Moose Management Plan (ADF&G files) that was submitted to the Alaska Board of Game during the March 2000 meeting. The draft plan was used as a guide for management goals, objectives, activities, and biological decision-making criteria in this management report. The board, at its January 2001 meeting, endorsed the plan.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

As noted in the previous report, the unitwide moose population increase observed for almost 2 decades had ended and some localized areas showed marked declines. Peak densities of moose were apparently reached between 1993 and 1997, but declining calf numbers and recruitment of yearlings began to be apparent in fall 1998 and 1999 in most TCAs (Tables 1–8). Estimates of poor recruitment during 1998–2001 in the Three Day Slough area suggested a decline of as much as 25%. Since 1997 the Unit 21D population may have declined by 10–15%, and the population trend was downward. Counts from several TCAs during 1999–2003

supported this conclusion, as did the 2001 population estimation survey. However, declines seemed to be largest in the high-density areas, while the low-density areas appeared to remain relatively stable. The proportionally larger low-density areas may have mediated the decline over the whole population.

My population estimate of 8500–9500 moose is based on previously reported values, trend count surveys conducted in RY03, and the population estimation survey completed in 2001. Declining moose recruitment among the trend areas was a key indicator of the apparent overall decline in the population. However, the 2001 survey showed that in low-density areas not surveyed annually, moose numbers apparently remained relatively stable. In fall 2001, 5526 mi^2 were surveyed in Unit 21D and the southern portion of Unit 24. Of the 975 sample units in the survey area, 291 sample units were surveyed intensively. We counted 4524 moose during the intensive surveys with an average survey time of 30.8 minutes per 5.6 mi^2 sample unit. Nine hundred seventy-five sample units were stratified in advance of the intensive survey, with 255 of the sample units classified as high moose density, while the remaining 720 sample units were classified as low moose density. In the 3577-mi^2 portion of Unit 21D that was surveyed, we estimated 5203 moose, not including a sightability correction factor (Table 9). In the remaining 8536 mi^2 of Unit 21D not surveyed, I estimated an average density of 0.45 moose/mi^2 or 3841 moose.

Population Composition

The following guidelines were used to interpret sex and age indices (Franzmann and Schwartz 1998).

- Bull:cow ratios in some of the high density TCAs were in excess of 30–40 bulls:100 cows after the fall hunting season. Ratios of 15 bulls:100 cows are sufficient for breeding (Woolington 1998) in these areas, with higher ratios providing increased harvest or trophy hunting opportunity. High numbers of bulls are sometimes misleading in terms of harvest effects on the population because Unit 21D is subject to either-sex hunting which can inflate bull ratios.

- The calf:cow ratio observed during November surveys provides an index to calf survival during the calves' first 5 months. Black bears, grizzly bears, and wolves were the primary predators that reduced calf numbers (Osborne et al. 1991). A November calf:cow ratio of 20–40 calves:100 cows may allow a population to remain stable. Calf:cow ratios may indicate population change if subsequent overwinter mortality is either consistent or negligible. Ratios of <20 calves:100 cows may indicate a decreasing population and ratios of >40 calves:100 cows can be found in growing populations.

- The percentage of yearling bulls within the herd provides an index of the recruitment of young adults to the breeding population. It can also provide an indication of overwinter survival of calves, if the calf:cow ratio for the previous fall is known. Generally, the yearling bull percentage averages 4–8%, with anything less indicating poor recruitment and with anything higher indicating good recruitment.

Since 1995 the posthunt bull:cow ratio for the Three Day Slough TCA was generally declining, with the fall 2003 ratio being the lowest recorded (Table 1). Bull:cow ratios vary widely among other TCAs (Tables 2–8), but most indicate some level of decline since 1995 or 1996. The percentage of large bulls (antlers ≥50") observed in the Three Day Slough TCA was 15–30% in the 1990s, while the percentage of large bulls in the harvest from Three Day Slough was 40–68% (Table 10). Bull:100 cow ratios from the 2001 GSPE survey were estimated at 33:100, well above the minimum needed for adequate productivity. For the area surveyed in 2001, the calf:100 cow ratio was estimated at 18:100. That calf ratio was lower than the target range (20–40:100) for maintaining a stable population. Data from most of the TCAs had even lower ratios however, which suggested the low density areas away from the TCAs maintained higher levels of productivity and recruitment to 5 months and probably acted to moderate the overall decline of the population. Although a GSPE survey was not conducted in RY02 or RY03, and no TCA surveys were conducted in RY02, TCA data in RY03 demonstrated substantial improvements in calf:cow ratios and yearling bull:cow ratios.

Calf twinning rates in spring 2003 and 2004 suggested improving productivity in Unit 21D (Tables 11 and 12) and the Huslia Flats–Treat Island TCAs area just to the north in Unit 24. We suggest this improvement is related to the 3 to 4 prior consecutive mild winters and the corresponding length of the intervening snow-free seasons. Although no objective measurements of habitat were conducted during this period, I observed no dramatic changes in vegetative characteristics that would account for the apparent improvements in twinning rates. Thus, I do not believe a density-dependent effect was acting on the population because twinning rates declined only temporarily while the moose population maintained relatively high and stable densities.

Distribution and Movements

Movement patterns of moose in the Three Day Slough area are based on data from radiocollared animals (Osborne and Spindler 1993). Most adult and young moose remain in the floodplain area of Three Day Slough from late August until May each year. During May most moose move 10–60 miles north or south to upland areas where they spend the summer. In August they return to the floodplain area.

Moose movements are unknown in other portions of the subunit. However, local residents suspect some moose observed on the Kaiyuh Flats migrate seasonally to the south.

Generally, moose congregate along the river corridors in late fall with the approach of peak rutting season. With the accumulation of snow, moose are in high concentrations within the riparian corridor of the Yukon and Koyukuk Rivers, where they remain throughout the winter. With spring breakup, bulls are the first to leave the riparian areas, followed by cows that have calved. Osborne and Spindler (1993) found approximately 58% of the cows migrated after calving and approximately 83% of all moose were migratory.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 21D, that portion within the Koyukuk Controlled Use Area.		
RESIDENT HUNTERS: 1 moose per regulatory year, only as follows:		
1 moose by registration permit only; or	27 Aug–31 Aug (Subsistence hunt only)	
1 bull by registration permit only; or	1 Sep–20 Sep (Subsistence hunt only)	
1 bull by drawing permit only; up to 320 permits may be issued in combination with Unit 24, that portion within the Koyukuk Controlled Use Area; or	5 Sep–25 Sep (General hunt only)	
1 moose during a 5-day season to be announced by emergency order during 1 Feb–28 Feb; a person may not take a cow accompanied by a calf.	(To be announced) (Subsistence hunt only)	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side by drawing permit; up to 80 permits may be issued in combination with Unit 24, that portion within the Koyukuk Controlled Use Area.		5 Sep–25 Sep
Remainder of Unit 21D		
RESIDENT HUNTERS: 1 moose per regulatory year; however, antlerless moose may be taken during 21 Sep–25 Sep and during a 5-day season during the period 1 Feb–28 Feb to be announced by	5 Sep–25 Sep (To be announced)	

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
emergency order; a person may not take a cow accompanied by a calf. NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. The antlerless moose hunting seasons were reauthorized by the Alaska Board of Game for RY02 and RY03, but we notified the board that the antlerless season would be closed by emergency order for the fall 2004 season because of conservation concerns. Also at the March 2002 meeting, the board expanded the meat-on-the bone salvage requirement in the Koyukuk CUA to all of Unit 21D.

At the 2004 meeting, the board adopted changes to the moose regulations in Unit 21D that implemented drawing and registration hunts in the Gisasa and Kateel River drainages and the Bear Creek drainage. The board also closed the February any-moose season and opened a 10-day December bulls-only season.

Hunter Harvest. During the reporting period, harvest of moose in Unit 21D was reduced and stabilized compared to the increases observed during the 1990s (Tables 13–15). The decline in the bull segment of the population in some TCAs was probably linked to the harvest during that period. Cow harvest was further reduced in RY03 primarily due to elimination of the antlerless moose seasons in the KCUA. However, much of the cow harvest occurred during the winter, when harvest reporting was poor.

Checkstation Results. Ella's cabin checkstation, located 15 miles upstream from the village of Koyukuk on the Koyukuk River, was made mandatory in RY90. Hunters checking in at Ella's reached an all-time high in RY99, but the number dropped significantly with the implementation of the drawing hunts in RY00. During the period of increase, the additional hunters in the KCUA were primarily nonlocal Alaska residents and, secondarily, nonresidents (Table 15). Numbers of local residents (residents of Unit 21D) remained relatively constant. Harvest success was high (>60%) for nonresidents and nonlocal residents. Local resident harvest success reported for the fall hunt was lower, in part, because they could easily hunt the winter season if they were unsuccessful in the fall. Success rates generally remained high except for RY01, but that was probably due to the extremely warm weather during the fall hunting season.

The Three Day Slough area is well known as an excellent area to hunt for large (≥50-inch antlers) moose. One-fifth to one-third of the bulls observed in the Three Day Slough TCA had large antlers (Table 10). Consistently over the past 23 years, more than 17% of the bulls checked at Ella's cabin had antler spreads >60 inches.

Three regulations monitored closely at the checkstation were antler width, salvage of meat, and destruction of trophy value of bulls harvested under subsistence registration permits. The regulation requiring meat to be left on the bone improved enforcement efforts to stop waste of moose meat. This regulation was passed in 1992 to address the increase of moose hunters and harvest in the KCUA, and to address the problem of some hunters removing only part of the meat from the carcass so they could carry lighter loads in their boats. All hunters who came through the checkstation were notified of this regulation at the time permits were distributed. Hunters were checked for compliance of the regulation upon departure. Destruction of the trophy value of antlers at the checkstation was a controversial regulation when applied and seldom resulted in a positive public contact for the department. Beginning in RY00, hunters were required to cut the antlers at the kill site, which improved that aspect of the hunter contact.

Antler widths for the moose harvested in the KCUA were analyzed across all age classes from RY81 through RY03. Analysis showed variation on an annual basis with no apparent similarities to trends in other population data until RY97. Beginning in RY97 through RY00, all mean antler widths of the 5 age classes (3–7 yr olds) were below the 23-year mean antler widths for the respective age classes (Fig 1). Among those 20 data points (5 age classes × 4 years), 10 of 20 of the mean antler widths were significantly lower than the 23-year mean widths for the respective age classes. Antler widths for age classes below 3 years old or above 7 years old did not show consistent differences from their 23-year mean widths. After RY00, antler widths appeared to return to the range of the 23-year mean values for all age classes, with the exception of the 1993 cohort. The 4-year decrease in antler widths coincided with the observed decline in the twinning rates during that period. Declines in antler development and twinning rates have similarly been associated with energetic deficits, and the 4-year declines in both of these measurements for the KCUA suggest a temporary environmental effect was influencing both parameters.

Meat evaluation surveys conducted at the checkstation indicated meat care was generally very good with the average scores of 4.3 and 4.2 for RY02 and RY03 respectively (Table 16). In RY03 the majority of hunters (69%) had their meat out of the field in 4 days or less. In RY02, 16 hunters (8.6%) had their meat out 7 days or longer, and in RY03 there were 25 hunters (12.6%) that kept their meat out that long, 1 hunter staying out with meat for 12 days. Cooler weather during fall RY03 allowed for longer stays without meat spoilage, but meat quality measurements do show a decline after 5 or 6 days in the field. In RY02, 27 hunters (15%) were given scores of 3 or less, while that number increased to 43 hunters (22%) in RY03.

Wildlife viewing surveys were conducted voluntarily at the checkstation. There were 96 and 80 people who filled out the wildlife-viewing questionnaire at Ella's cabin in 2002 and 2003. The survey was printed on a 3×5 card with 8 questions. Typically, we handed out 1 card per party rather than for each individual. We presented the card to hunters while we were checking them on their way out of the area. In 2003, 507 hunters registered at Ella's, so this was roughly a 16% sample (down from 25% in 2002) of registered hunters who went through the checkstation.

Not all hunters answered all of the questions, so many of the percentage values presented are with the respect to the number of responses to the particular question. The questions asked and the answers given are summarized below for RY02–RY03:

Question 1: How many days spent viewing wildlife?

Respondents reported spending an average of 7.0 days in RY02 and 6.9 days in RY03 viewing wildlife. This question was slightly different in RY03 from the 2 similar questions from RY02, the second of which read "…how many days were you in the KCUA?" I think the question was less redundant in RY03 than the 2 questions on the RY02 survey.

Question 2: Why were you visiting the Koyukuk?

The majority (55% in both RY02 and RY03) of the people said they were "Hunting and Viewing," while 43% in RY02 and 49% in RY03 said they were hunting only, while 2% in RY02 and 1% in RY03 said they were viewing only. This question and the number of days spent viewing may be the 2 most obvious measures for future comparison to determine if the viewing activities are increasing. I felt it was a very good indicator to demonstrate that hunters were not just there to shoot something. The consistency in the data from 2002 was remarkable.

Question 3: Did you view any wildlife that you were not hunting?

The majority (83% in RY02 and 81% in RY03) of respondents said yes, while only 17% in RY02 and 19% in RY03 said no.

Question 4: What wildlife species did you see and how many?

There were 62 people who listed some of the animals they saw. In both RY02 and RY03, very few people were willing to write down a comprehensive list of all the wildlife they observed. Only a few (less than 12) filled in the "how many" section. Moose, beaver, ducks, geese, porcupine, and gray jays were the top species listed. There were 32 species identified in RY03 compared to 23 listed in RY02. For RY03 this question did not appear to try the patience of hunters as I thought it did in RY02. I think hunters were probably more comfortable with the idea of filling out the form in RY03.

Question 5: Viewing which of these animals was most important to you?

This question got a variety of responses both years and there were a variety of ways it was filled out in RY03. However, with some improved wording, I think reporting in RY03 was much better than it was in RY02. The top 5 species people wanted to see during RY02 and RY03 were as follows; moose = 74% and 86% of first place rank, bears = 58% and 75% of the second place rank, wolves = 57% and 56% of the third place rank, waterfowl = 54% and 62% of the fourth place rank, and furbearers = 59% and 71% of the fifth place rank. In addition, I identified an error in the RY02 calculation and recalculated those values, which resulted in a switch in the ranking of waterfowl and furbearers. The percentage calculation is actually a cumulative percentage and more accurately represents the ranking of the individual

species/wildlife classes. Caribou, songbirds, and small mammals were ranked sixth, seventh, and eighth respectively.

Question 6: How important was the activity of viewing wildlife for you?

This question was revised and obviously improved in RY03 to include only 3 categories. Of the people who responded during RY03, 62% said viewing was VERY IMPORTANT, 33% said it was SOMEWHAT important, and only 5% said it was NOT IMPORTANT.

Question 7: How important was seeing wildlife sign to your overall experience?

Like question 6 this question was improved from RY02. Of the people who responded during RY03, 52% said viewing was VERY IMPORTANT, 44% said it was SOMEWHAT important, and only 4% said it was NOT IMPORTANT.

Question 8: Where did you get information about the Koyukuk?

FRIENDS was the number one source both years at 45% and 51%, second was PERSONAL KNOWLEDGE (i.e., I live here) at 23% and 18%, ADF&G at 17% and 9%, FAMILY at 4% and 9%, INTERNET at 3% and 5%, FWS at 4%, and a variety of other answers for the remaining 4%.

With the establishment of the baseline data for the meat evaluation and wildlife viewing, efforts to improve the activities can be implemented according to management goals 3 and 4.

Permit Hunts. Use of the subsistence registration permit (RM832) hunt was required in the fall within the entire Koyukuk Controlled Use Area. The number of RM832 permits issued for RY02 decreased by 10.9% from RY01 and then increased by 11.7% in RY03 (Table 17). So, it appears that use of the RM832 permit has stabilized. It is apparent that use of the registration permit has increased among Unit 21D residents while use of the permit by other Alaska residents is down somewhat (Table 14). Increases in the number of Alaska resident hunters using the subsistence permit alternative may exceed the sustainable yield of the moose population and has been a critical management issue. With the implementation of the 4 drawing hunts DM827, DM828, DM829 and DM830, hunter numbers were better regulated. As compared to their predecessor, the RM830 permit, the number of drawing permits issued was stable and not increasing without control. Hunters who did not want to destroy the trophy value of their bull moose applied for a drawing permit. An added benefit to hunters awarded a drawing permit was that they did not need to be concerned with whether permits were available at the checkstation. Also, hunters commented favorably on the changes to season dates that separated drawing hunters from registration hunters and evenly distributed drawing hunters in either the first or second half of the season.

Hunter Residency and Success. Hunter residency and success can be misleading because Unit 21D residents often did not report unsuccessful hunt information (Table 18). Harvest and hunter participation by Unit 21D residents was relatively constant according to Subsistence Division surveys (Anderson et al. 1998; Table 18). In contrast, nonresident and nonlocal resident hunter participation increased steadily from 1983 through 1999. The increase in

nonlocals created tension among user groups in the area and was the impetus for creating the KWG. With the implementation of drawing permits within the KCUA in RY00, local hunter participation appeared to increase in that area and their success rates improved for 3 consecutive years (RY01–RY03) in the KCUA. However, success rates in RY01 (42%) and RY02 (45%) are still low compared to the early 1990s (RY90–RY97) when success rates averaged 62%. Maintaining high success rates for local hunters in the fall is particularly important, because if they do not get their moose in the fall, they are more likely to hunt in the winter seasons when more than 60% of the moose harvested are cows.

Harvest Chronology. Harvest reporting rate was low during the winter seasons and was probably 20% of the annual harvest (Table 19). Much of the unreported harvest was likely taken during October–March (Anderson et al. 1998).

Transportation Methods. The presence of the KCUA and the area's extensive river system made boats the primary transportation method (Table 20). Snowmachines were the main transportation during the winter hunt.

Other Mortality

Unit 21D has high populations of wolves and black bears. Grizzly bears were common in the upland areas of the Nulato Hills and Kaiyuh Mountains. Wolves and grizzly bears prey heavily on both calf and adult moose. Black bears were shown to kill more than 40% of moose calves annually (Osborne et al. 1991). Hunters continued to report increased observations of grizzly bears during the fall moose season. Anecdotal reports from Unit 21D residents also suggested grizzly bears were increasing and becoming more common intruders at fish camps.

We estimated 208–304 wolves in 37 packs in a portion of Unit 21D during 1994 (Becker et al. 1998). Local residents with intimate knowledge of the unit's game populations report wolf numbers substantially increased since then. Packs in excess of 20 wolves were observed during fall 1999 moose surveys. We counted 126 wolves during a wolf reconnaissance survey in March 1999. This minimum count indicates an increase of at least 17% from the number of wolves in packs also observed during the 1994 survey.

HABITAT

Assessment

Feltleaf willow is an important browse species for moose due to its nutritional quality and use (Kielland 1997). Chemical analysis of 0.08- to 0.32-inch diameter twigs typically browsed by moose in Three Day Slough found crude protein was 8–12%, twice as much as found in the same willow species on the Tanana River. Consumption in Three Day Slough survey areas was 24–28% of the annual twig production (Kielland 1997). These factors may partly explain the sustained high numbers of moose in the Three Day Slough area. Annual forage production for a measurable area is unknown.

In April 2002 we conducted 6 browse transects in Unit 21D to evaluate sampling techniques that could potentially be used in the Galena Management Area.

MANAGEMENT PLANNING

The KWG met twice in RY01 and RY02, and the management plan (ADF&G files) developed by the working group was formally endorsed by the Board of Game at its winter 2001 meeting. The plan was the basis for developing goals and activities for moose management in Unit 21D. Although the KWG's area of concern was specifically within the Koyukuk River drainage, the issues were characteristic of concerns throughout Unit 21D and nearby Unit 24.

CONCLUSIONS AND RECOMMENDATIONS

Moose were relatively numerous in the riparian lowlands of Unit 21D. I estimated 8500–9500 moose in the unit. Unitwide populations probably declined as a result of declining recruitment, at least during 1998–2002. Declining recruitment parameters such as calf:cow ratios and yearling bull:cow ratios indicated predation had a negative influence on the moose population. Also, 4 years of liberalized cow harvest removed an important reproductive component of the population. This decline in moose numbers is supported by the increase in wolf numbers observed during the aerial wolf reconnaissance survey in 1999, observations of black bears in the field, and increased observations of grizzly bears by hunters. The population will likely continue to decline unless an effort to control predation is implemented and the harvest of antlerless moose continues to decrease.

The 3 key management issues facing Unit 21D include (1) area-specific concentration of hunting activities, (2) cow harvest, and (3) the repercussions of declining fall success rates by local hunters. Concentration of hunters in the portion of the KCUA between the Kateel River and the Dulbi Slough area has impacted the bull:cow ratio in that area. As a result of the low bull:cow ratio in Three Day Slough, a decision was made to reduce the number of drawing permits from the 258 issued in RY03 down to 50 permits for RY04. The Koyukuk River Moose Management Plan objectives call for a ratio of 30 bulls:100 cows in the KCUA, so conservative management strategies were implemented to decrease the number of bulls harvested. Although normal breeding activity can occur at ratios of 20–30 bulls:100 cows when moose are at high densities, ratios below 20 are cause for concern biologically, especially when the trend is continuing downward. Cow harvest must continue to decrease, especially during the winter seasons. Actions were taken to close all the fall cow seasons by emergency order in RY02 and RY03, and in RY04 the winter season was shifted to December and only bulls were legal to harvest. However, it is clear that dependency on moose harvested during the winter will continue as long as fall hunting success declines. The repercussion of the dependency on winter harvest is that more than two-thirds of the moose harvested are cows. Management efforts must continue to improve fall success rates by local hunters in order to reduce the winter harvest of cows.

The objective of maintaining the population at 9000–10,000 moose was probably achieved by a narrow margin; however, without survey data at the end of RY02 that evaluation was not clear. Analysis of RY03 data indicated improved recruitment, which supports the conclusion that we met the objective. Poor recruitment prior to RY02, due in part to high predation, appears to be the primary factor causing the apparent decline. The objective to provide for a harvest of moose not to exceed 700 moose was achieved. From RY01–RY03, estimated total

harvest was highest in RY02 at 490 moose, a harvest rate of no more than 5.8%, even if the population was at its lowest point of 8500 moose. The objective to provide for moose hunting opportunity, not to exceed 950 hunters per regulatory year was achieved with a total of only 737 hunters in RY01, 650 hunters in RY02 and a preliminary count of 773 in RY03.

The long-term objective of implementing at least 2 habitat enhancement activities was not achieved directly during RY01–RY02, but coordination with the FWS concerning potential treatment is in progress.

In RY02 and RY03 we monitored the objective of reducing spoiled meat observed at Ella's cabin and at hunting camps by 10% each regulatory year. I believe regulations adopted by the board in 1992 that required meat to remain on the bone of all 4 quarters and the ribs was a positive move toward achieving the objective of reducing spoiled meat. This requirement was expanded to all of Unit 21D in RY02. We established baseline data to monitor our success in meeting this objective in RY02 and RY03. Finally, a monitoring program to evaluate the number of people engaged in nonconsumptive activities was developed and baseline data were established so we will be able to determine whether we meet the objective to increase the number of people engaging in nonconsumptive uses of wildlife by >1% each regulatory year. Coordination with the FWS on this objective took place during the report period, and survey forms were developed to monitor nonconsumptive wildlife activities.

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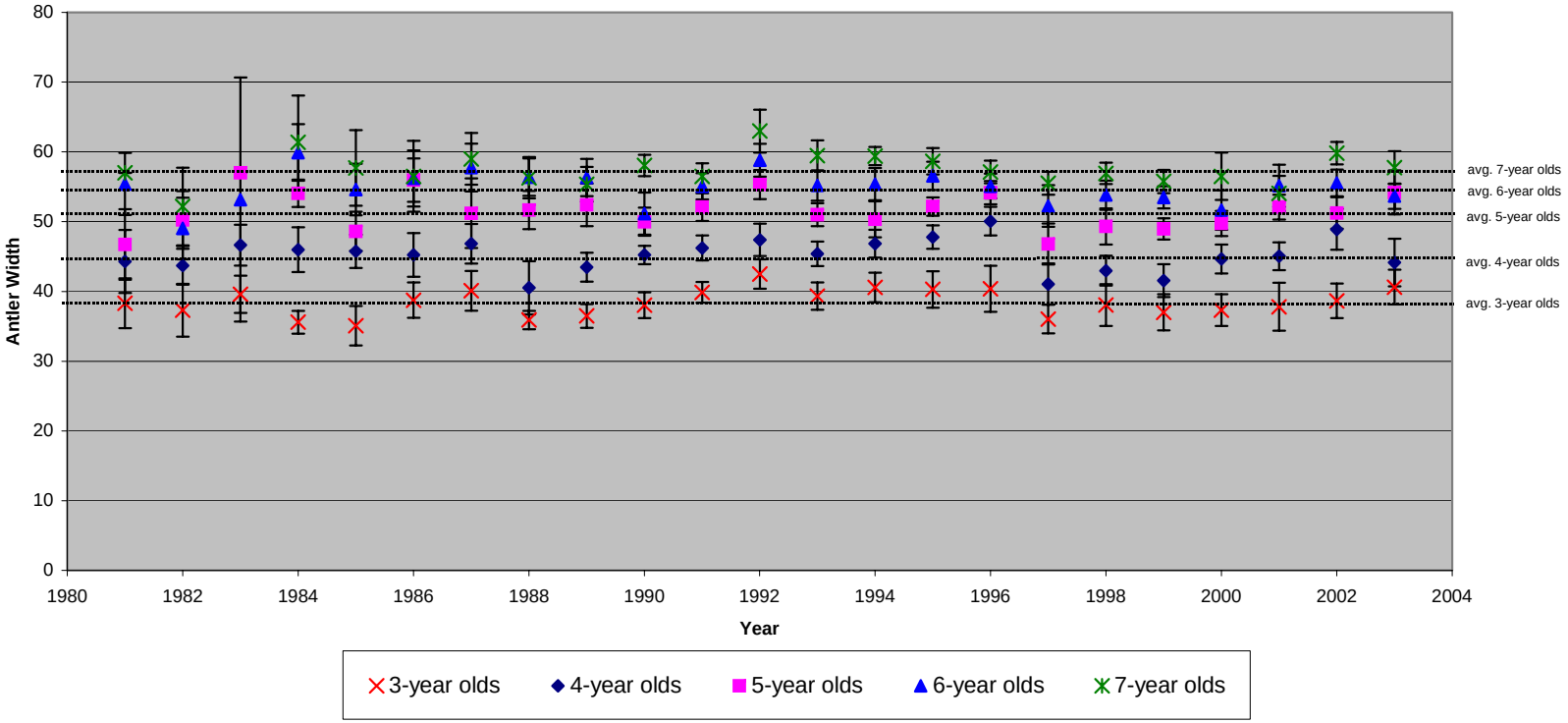

FIGURE 1 Moose antler widths and ages determined by incisor cementum annuli for 3- to 7-year-old moose checked at Ella's cabin, regulatory years 1983–1984 through 2003–2004

TABLE 1 Unit 21D Three Day Slough trend count area aerial moose composition counts, regulatory years 1981–1982 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1981–1982[a]	85.1	35	12	42	10	24	327	3.8
1982–1983[a]	85.1	43	13	24	2	14	415	4.9
1983–1984	84.8	31	9	37	12	22	530	6.3
1984–1985	57.8	30	13	31	10	19	332	5.7
1985–1986	83.3	39	11	17	4	11	501	6.0
1986–1987	83.3	39	7	45	13	25	660	7.9
1987–1988[a]	83.3	36	13	32	11	19	791	9.5
1988–1989	83.3	33	13	45	14	25	832	10.0
1989–1990	83.3	28	8	25	11	16	763	9.2
1991–1992[a]	83.3	34	10	31	6	19	909	10.9
1992–1993	83.3	35	10	31	7	18	1088	13.1
1993–1994[a]	83.3	38	8	25	4	16	1106	13.3
1994–1995	83.3	36	9	28	5	17	1026	12.3
1995–1996	83.3	23	7	36	6	23	1054	12.7
1996–1997	83.3	24	8	23	4	15	928	11.1
1997–1998	83.3	20	9	24	3	17	721	8.7
1998–1999	83.3	30	9	13	0	9	990	11.9
1999–2000	83.3	17	3	17	18	13	568	6.9
2001–2002	85.0	22	7	13	0	8	678	8.0
2003–2004	85.0	15	8	21	14	14	586	6.9

[a] Huntington and Spindler 1997.

TABLE 2 Unit 21D Dulbi River mouth trend count area aerial moose composition counts, regulatory years 1982–1983 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1982–1983	42.1	36	7	29	12	17	166	3.9
1983–1984	57.1	39	7	29	8	17	230	4.0
1984–1985	42.1	36	4	44	10	24	184	4.4
1987–1988	38.9	55	17	44	15	22	283	7.3
1992–1993	51.7	41	6	43	21	23	271	5.2
1996–1997	51.7	34	11	36	6	21	281	5.4
1997–1998	52.4	28	6	32	4	20	283	5.4
1999–2000	52.4	24	2	42	2	25	225	4.3
2000–2001	52.4	16	6	15	6	12	307	5.9
2001–2002	52.4	25	6	14	5	10	217	4.1
2003–2004	52.4	21	8	21	3	15	235	4.5

TABLE 3 Unit 21D Kateel River mouth aerial moose composition counts, regulatory years 1984–1985 through 1997–1998 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1984–1985	47.8	21	8	54	5	31	68	1.4
1987–1988	38.0	41	20	41	12	23	84	2.2
1996–1997	49.4	46	15	29	14	16	152	3.1
1997–1998	61.1	26	10	34	0	21	188	3.1

TABLE 4 Unit 21D Long Stretch (Koyukuk River) aerial moose composition counts, regulatory years 1984–1985 through 1997–1998 (Huntington and Spindler 1997)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1984–1985	51.5	94	31	31	25	14	36	0.7
1996–1997	51.3	36	6	61	25	31	65	1.3
1997–1998	62.5	47	7	33	0	18	77	1.2

TABLE 5 Unit 21D Koyukuk River mouth aerial moose composition counts, regulatory years 1984–1985 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1984–1985	65.5	27	10	41	5	25	183	2.8
1987–1988	37.8	28	8	49	12	28	69	1.8
1993–1994	51.2	43	10	36	6	20	175	3.4
1996–1997	51.2	42	6	45	7	24	181	5.1
1997–1998	66.5	35	6	50	10	27	284	4.3
1999–2000	66.5	36	10	19	6	13	288	4.4
2001–2002	66.5	41	8	17	0	11	267	4.0
2003–2004	66.5	26	11	41	9	25	372	5.6

TABLE 6 Unit 21D Squirrel Creek aerial moose composition counts, regulatory years 1981–1982 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1981–1982	40.7	93	49	34	8	15	93	2.3
1982–1983	37.3	57	18	41	0	21	87	2.3
1983–1984	37.3	58	14	35	14	18	137	3.7
1985–1986	49.3	78	30	11	13	6	185	3.8
1987–1988	38.4	76	20	67	20	27	131	3.4
1993–1994	37.2	49	4	22	0	13	195	5.2
1995–1996	48.8	43	14	31	8	18	222	4.6
1997–1998	48.6	54	24	32	8	17	253	5.2
1998–1999	48.6	41	12	31	13	18	283	5.9
1999–2000	48.6	69	19	24	3	13	246	5.1
2000–2001	48.6	47	9	14	6	9	223	4.6
2001–2002	48.6	46	5	25	2	15	289	6.0
2003–2004	48.6	34	8	23	44	15	227	4.7

TABLE 7 Unit 21D Pilot Mountain Slough aerial moose composition counts, regulatory years 1983–1984 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1983–1984	36.5	21	8	52	11	30	133	3.6
1984–1985	36.5	11	2	47	39	30	84	2.3
1985–1986	36.5	27	11	9	0	7	90	2.5
1987–1988	35.7	36	18	49	11	26	185	5.2
1991–1992	23.2	24	8	54	14	30	161	6.9
1993–1994	35.4	21	1	39	10	24	135	3.8
1995–1996	34.3	20	14	57	14	32	203	5.9
1997–1998	47.3	12	4	32	11	22	222	4.7
1998–1999	47.3	18	6	28	2	19	297	6.3
1999–2000	47.3	18	8	39	3	25	243	5.1
2001–2002	47.3	26	9	40	7	24	238	4.8
2003–2004	47.3	13	10	45	14	28	259	5.5

TABLE 8 Unit 21D Kaiyuh Slough aerial moose composition counts, regulatory years 1985–1986 through 2003–2004 (Bryant and Stout 2003)

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 Cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1985–1986	50.8	54	17	8	0	5	78	1.5
1987–1988	39.1	28	7	33	7	20	74	1.9
1992–1993	50.8	36	18	24	22	15	72	1.4
1994–1995	50.8	44	12	31	0	18	119	2.3
1996–1997	64.3	60	13	67	6	30	125	1.9
1997–1998	64.3	35	12	39	10	23	146	2.3
1998–1999	64.3	42	18	48	10	25	173	2.7
1999–2000	64.3	39	12	22	13	14	129	2.0
2000–2001	64.3	41	9	31	15	18	127	2.0
2001–2002	64.3	55	4	7	0	5	112	1.8
2003–2004	64.3	46	19	42	23	22	130	2.1

TABLE 9 Unit 21D moose population estimates of 1997 and 2001 population estimation surveys (Bryant and Stout 2003)

Survey area	1997 Population estimate[a]	1997 Survey area (mi^2)	2001 Population estimate[b]	2001 Survey area (mi^2)
Kaiyuh Slough Sub-Area	1335 ± 230	1582	1800 ± 591	1843
Western Galena Sub-Area	3250 ± 403	1508	3403 ± 603	1734
Upper Koyukuk Sub-Area[c]	n/a	n/a	3642 ± 572	1949
Total Survey Area	4585 ± 633	3090	8924 ± 1161	5526

[a] Regression analysis estimate.
[b] Spatial analysis estimate.
[c] Predominantly within Unit 24.

TABLE 10 Unit 21D large bull[a] moose percent harvested and number measured during the hunting season and percent counted during aerial surveys in the Three Day Slough area (UCU 0804), regulatory years 1990–1991 through 2003–2004

Regulatory year	% Harvested (Sep)	Number measured (Sep)	% Counted (Nov)
1990–1991	54	91	–[b]
1991–1992	45	134	15
1992–1993	54	88	15
1993–1994	53	107	18
1994–1995	67	88	28
1995–1996	61	150	27
1996–1997	68	123	20
1997–1998	63	120	16
1998–1999	61	209	30
1999–2000	65	220	21
2000–2001	37	119	–[b]
2001–2002	40	83	30
2002–2003	46	97	–[b]
2003–2004	57	108	25

[a] 50-inch or greater antler spread.
[b] No survey.

TABLE 11 Unit 21D moose aerial twinning surveys in the Three Day Slough trend count area, regulatory years 1989–1990 through 2003–2004

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[a]	Yearlings	Dates in May
1989–1990		24	21	47		21–25
1991–1992		22	23	51		22–23
1992–1993	296	23	19	44	100	23–25
1993–1994	110	39	11	22	55	23–24
1994–1995	78	37	18	33	38	22
1995–1996	200	39	13	26[b]	51	22,24
1996–1997	180	30	9	23	58	23–24
1997–1998	70	29	4	12	11	20–30
1998–1999	28	37	3	8	14	4–7[c]
1999–2000	101	53	8	13	47	27–29
2000–2001		38	6	14		28–30
2001–2002	30	13	3	19	2	29–6/1
2002–2003	18	37	14	27	21	27,28
2003–2004	44	35	25	42	31	26,27

[a] Percent of cows with calves that had twins.
[b] Including 1 cow w/3 calves.
[c] The 1999 survey was delayed to 4–7 June due to weather.

TABLE 12 Unit 21D moose aerial twinning surveys in the Pilot Mountain Slough to Kaiyuh Slough trend count areas, regulatory years 2003–2004 (FWS)

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[a]	Yearlings	Dates in May
2003–2004	52	32	18	36	28	24,25

[a] Percent of cows with calves that had twins.

TABLE 13 Unit 21D moose harvest, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest by hunters				Unreported Harvest[a]	Potlatch/ Stickdance	Total
	Bull	Cow	Unk	Total			
1990–1991	258	24	1	283	40	4	327
1991–1992	269	34	0	303	40	11	354
1992–1993	193	22	1	216	40	11	267
1993–1994	235	23	2	260	40	9	309
1994–1995	248	26	1	275	40	8	323
1995–1996	329	21	1	351	40	4	395
1996–1997	315	110	1	426	150	4	580
1997–1998	336	73	1	410	150	4	564
1998–1999	340	80	3	423	150	1	574
1999–2000	336	127	3	466	150	3	619
2000–2001	320	35	0	355	150	10	515
2001–2002	247	49	2	298	150	13	461
2002–2003	316	10	0	326	150	14	490
2003–2004[b]	317	9	1	327	150	13	490

[a] Unreported harvest based on Subsistence Division's door-to-door survey.
[b] Preliminary data.

TABLE 14 Ella's cabin checkstation moose harvest, regulatory years 1990–1991 through 2003–2004[a]

Regulatory year	Bull	Cow	% Cow	Total
1990–1991	177	6	3	183
1991–1992	199	10	5	209
1992–1993	161	6	4	167
1993–1994	179	6	3	185
1994–1995	192	10	5	202
1995–1996	279	8	3	287
1996–1997	263	90	25	353
1997–1998	257	49	16	306
1998–1999	284	61	18	345
1999–2000	275	94	25	369
2000–2001[b]	266	11	4	278
2001–2002[b]	183	3	2	187
2002–2003	217	0	0	217
2003–2004	248	0	0	248

[a] Contains moose harvested in Units 21D and 24.
[b] 1 moose unknown sex

TABLE 15 Ella's cabin checkstation[a,b] moose hunter residency and success, regulatory years 1983–1984 through 2003–2004

Regulatory	Unit 21D resident		Alaska resident[c]		Nonresident		Total	
year	Hunter	Moose	Hunter	Moose	Hunter	Moose	Hunter	Moose
1983–1984[d]	132	43	29	20	3	2	164	65
1984–1985[d]	92	61	67	36	9	9	168	106
1985–1986[d]	117	32	74	37	4	3	195	72
1986–1987[d]	140	48	80	51	9	7	229	106
1987–1988[d]	151	68	92	61	21	16	264	145
1988–1989[d]	158	73	121	88	20	20	299	181
1989–1990	154	55	125	89	23	14	302	158
1990–1991	137	48	133	105	36	30	306	183
1991–1992	136	49	189	121	55	38	380	208
1992–1993	145	45	173	103	39	19	357	167
1993–1994	115	48	132	109	34	28	281	185
1994–1995	106	34	194	127	56	41	356	202
1995–1996	124	49	260	188	63	50	447	287
1996–1997	213	90	306	198	89	66	608	354
1997–1998	157	66	278	185	89	55	524	306
1998–1999	155	58	344	213	126	74	625	345
1999–2000	180	68	383	210	173	91	736	369
2000–2001	203	77	261	175	43	26	507	278
2001–2002	199	49	287	124	35	14	521	187
2002–2003	215	70	227	130	41	18	483	218
2003–2004	230	80	326	148	40	20	596	248

[a] Includes hunters from both Units 21D and 24.
[b] Includes hunters reporting at Huslia.
[c] Other than Unit 21D residents.
[d] Check not mandatory prior to 1990.

TABLE 16 Overall scores for meat evaluation at Ella's cabin, regulatory years 2002–2003 and 2003–2004

Regulatory year	Avg. no. days hanging	Avg. clean score[a]	Avg. dry score[a]	Avg. smell score[a]	Avg. overall score[a]	Sample size (*n*)
2002–2003	3.3	4.3	4.3	n/a	4.3	184
2003–2004	3.3	4.2	4.4	4.8	4.2	199

[a] Subjective ranking scale of 1–5, with a score of 1 being lowest.

TABLE 17 Units 21D and 24 Koyukuk Controlled Use Area moose harvest by permit hunt, regulatory years 1998–1999 through 2003–2004[a]

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
RM832	1998–1999	295	8	45	55	125 (77)	38 (23)	0	163
	1999–2000	356	9	49	51	127 (70)	54 (30)	1	182
	2000–2001	355	14	45	55	157 (93)	11 (7)	1	169
	2001–2002	403	15	62	38	126 (97)	3 (2)	1	130
	2002–2003	359	17	51	49	145 (100)	0 (0)	0	145
	2003–2004	401	12	55	45	155 (99)	0 (0)	2	157
RM830	1998–1999	330	5	45	55	159 (87)	23 (13)	0	182
	1999–2000	380	3	51	49	148 (79)	39 (21)	0	187
DM827	2000–2001	26	19	52	48	10 (100)	0 (0)	0	10
	2001–2002	26	19	68	32	5 (83)	1 (7)	0	6
	2002–2003	20	35	31	69	9 (100)	0 (0)	0	9
	2003–2004	26	19	63	37	7 (100)	0 (0)	0	7
DM828	2000–2001	103	51	22	78	38 (100)	0 (0)	0	38
	2001–2002	103	63	54	46	17 (100)	0 (0)	0	17
	2002–2003	79	56	45	55	17 (100)	0 (0)	0	17
	2003–2004	103	48	40	60	27 (100)	0 (0)	0	27
DM829	2000–2001	26	15	27	73	16 (100)	0 (0)	0	16
	2001–2002	26	15	50	50	8 (100)	0 (0)	0	8
	2002–2003	20	45	0	100	11 (100)	0 (0)	0	11
	2003–2004	26	12	38	62	13 (100)	0 (0)	0	13

Table 17 continued

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
DM830	2000–2001	103	41	25	75	45 (100)	0 (0)	0	45
	2001–2002	103	51	43	57	26 (100)	0 (0)	0	26
	2002–2003	79	38	16	84	41 (100)	0 (0)	0	41
	2003–2004	103	36	24	76	44 (100)	0 (0)	0	44
Total	1998–1999	625	7	41	59	284 (82)	61 (18)	0	345
	1999–2000	736	5	46	54	275 (75)	93 (25)	1	369
	2000–2001	613	25	39	61	266 (96)	11 (4)	1	278
	2001–2002	661	29	59	41	182 (97)	4 (2)	1	187
	2002–2003	557	27	46	54	217 (100)	0 (0)	1	218
	2003–2004	659	22	50	50	246 (99)	0 (0)	2	248

[a] RM830 ended in RY00 and was replaced by Drawing Hunts DM827, 828, 829, and 830.

TABLE 18 Unit 21D moose hunter residency and success, regulatory years 1990–1991 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total	
1990–1991	103	135	35	10	283	34	27	4	6	71	354
1991–1992	105	150	42	6	303	60	97	16	3	176	479
1992–1993	72	111	23	10	216	56	82	14	15	167	383
1993–1994	87	141	24	8	260	55	27	7	2	91	351
1994–1995	80	148	44	3	275	47	68	13	0	128	403
1995–1996	90	203	54	4	351	41	77	9	0	127	478
1996–1997	135	218	70	3	426	127	143	34	1	305	731
1997–1998	127	226	57	0	410	110	104	52	0	266	676
1998–1999	100	232	88	3	423	124	180	76	1	381	804
1999–2000	126	232	104	4	466	140	202	121	1	464	930
2000–2001	111	198	45	1	355	78	107	48	0	233	588
2001–2002	105	167	26	0	298	145	231	63	0	439	737
2002–2003	108	171	47	0	326	133	171	19	1	324	650
2003–2004[b]	95	164	52	16	327	185	190	59	11	445	772

[a] Subunit resident only.
[b] Preliminary data.

TABLE 19 Unit 21D moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2003–2004

Regulatory year	Harvest chronology percent by month/day			
	9/1–9/14	9/15–9/25	2/1–2/10	*n*
1996–1997	53	43	4	423
1997–1998	59	37	4	446
1998–1999	50	49	1	386
1999–2000	48	47	5	456
2000–2001	48	47	4	348
2001–2002	29	63	8	282
2002–2003	32	64	5	306
2003–2004[a]	46	48	6	309

[a] Preliminary data.

TABLE 20 Unit 21D moose harvest percent by transport method, regulatory years 1990–1991 through 2003–2004

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	Total
1990–1991	4	0	88	0	3	0	2	2	283
1991–1992	5	0	86	0	5	0	2	2	303
1992–1993	3	0	88	1	3	0	2	3	216
1993–1994	3	0	88	1	5	0	1	2	260
1994–1995	4	0	85	0	7	1	2	1	275
1995–1996	3	0	91	1	2	1	2	0	351
1996–1997	2	0	91	1	4	0	2	1	426
1997–1998	4	0	90	1	4	0	1	0	410
1998–1999	5	0	88	0	3	1	2	1	423
1999–2000	2	0	90	0	5	1	1	2	466
2000–2001	3	0	90	1	4	1	1	1	355
2001–2002	3	0	89	1	7	0	1	0	298
2002–2003	5	0	87	0	4	1	1	2	326
2003–2004[a]	7	0	87	0	6	0	0	1	327

[a] Preliminary data.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: 24 (26,055 mi^2)

GEOGRAPHIC DESCRIPTION: Koyukuk River drainage above Dulbi River

BACKGROUND

Moose are broadly distributed throughout much of Unit 24, with local densities (0.25–2.0 moose/mi^2) typical of Interior Alaska. Anecdotal evidence indicates the population was low prior to the 1930s, but increased during the 1930s–1950s (Huntington 1993). The rate of increase was probably slow until predator control efforts in the 1950s allowed rapid expansion of local populations, especially in the southern third of the unit. During the early 1970s the population reached a peak and mortality started to exceed recruitment in some areas. Populations apparently climbed again in the late 1980s, peaked around 1992, and then fell gradually through the remainder of the 1990s.

Naturally occurring wildfires and floods are major forces affecting the productivity and diversity of moose habitat in this area. Habitat is excellent along most of the Koyukuk River lowlands, providing extensive areas of winter browse. Lightning-caused fire is a frequent event and large areas of the burned uplands are productive browse communities. Based on personal observations, browse production does not appear to be limiting the size of the moose population at current moose densities.

The Koyukuk River and major tributaries are popular moose hunting areas for unit residents, other Alaska residents, and nonresidents. The lower portion of the Koyukuk within Unit 24 has been the focus of most of our management effort because of the long history of use, higher moose densities, and increasing hunting activity. Hunting activity was also increasing in other areas of the unit, including rivers accessible from the Dalton Highway. Two controlled use areas (CUA), the Koyukuk CUA and the Kanuti CUA, restrict use of aircraft for moose hunting activities. The Dalton Highway Corridor Management Area (DHCMA)

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

prohibits use of off-road vehicles and firearms for hunting within 5 miles on either side of the Dalton Highway. Access to portions of the unit increased with the opening of the highway.

There are several moose hunting seasons in Unit 24 that reflect the variety of moose densities and human-use patterns. In addition to the usual September hunting season, open seasons in December and March also provide hunting opportunity for residents of Alaska. A registration permit moose hunt was established in 1996 in the Koyukuk CUA, downstream from Huslia. Drawing hunts were established in the Koyukuk CUA in 2000, the DHCMA in 2002, and drainages around the Koyukuk CUA in 2004.

Annual reported harvests during the past 25 years were 44–230, but did not exceed 100 moose until 1980. Unreported harvests during this period probably were 160–300 moose per year (Woolington 1998). Since 1980, reported harvests have exceeded 100 moose each year. Local residents have become more aware of the importance of harvest reporting, resulting in increased compliance with reporting requirements.

MANAGEMENT DIRECTION

Management was directed according to the following management goals and objectives during the reporting period.

GOAL 1: Manage Koyukuk River drainage moose on a sustained yield basis to provide both hunting and other enjoyment of wildlife in a manner that complements the wild and remote character of the area and minimizes disruption of local residents' lifestyles.

Objective 1: Maintain a moose population of 10,000–12,000.

Activity 1: Conduct trend count surveys annually or population estimation surveys when funding is available.

Objective 2: Provide for a harvest of moose not to exceed 360 moose or 5% of the annual moose population estimate each regulatory year.

Activity 1: Monitor hunter use levels in the Koyukuk River drainage.

Activity 2: Monitor impacts (social and environmental) to private property and local residents by Koyukuk River moose hunters.

Activity 3: Develop programs to improve population and harvest data for moose in Unit 24.

Objective 3: Provide for moose hunting opportunity not to exceed 500 hunters per regulatory year.

GOAL 2: Protect and enhance moose habitat.

Objective 1: In combination with Unit 21D, implement at least 2 habitat enhancement activities every 5 years.

GOAL 3: Reduce meat spoilage by hunters.

Objective 1: Reduce the amount of spoiled meat observed at Ella's Cabin and at hunting camps by 10% each regulatory year.

Activity 1: Implement a program at Ella's Cabin checkstation to monitor percentage of meat lost due to spoilage.

GOAL 4: Maintain opportunities for wildlife viewing, photography and other nonconsumptive uses of wildlife within the Koyukuk River drainage.

Objective 1: Increase the number of people engaging in nonconsumptive uses of wildlife by >1% each regulatory year.

Activity 1: Implement a program to monitor long-term trends and establish a baseline of the current level of nonconsumptive use through collaboration with the Koyukuk–Nowitna and Kanuti National Wildlife Refuges, the Gates of the Arctic National Park and Preserve, and commercial operations in Unit 24.

METHODS

We surveyed established trend count areas (TCAs) of 4–6 contiguous "Gasaway" sample units from small fixed-wing aircraft (PA-18 or similar aircraft) to assess moose population parameters (Gasaway et al. 1986). We also established TCAs using a grid system based on latitude and longitude coordinates used to locate sample units (~5.7 mi^2 in size; Ver Hoef 2001). Surveys were flown approximately 500 ft above ground level at ground speeds of 70–80 mi/hr in fall. Moose were classified as cows, calves, yearling bulls (<30" antler width and no brow tine definition), medium bulls (<50" antler width), or large bulls (≥50" antler width). Sample units of approximately 12 mi^2 each were searched at a rate of approximately 5 min/mi^2 to ensure reasonably high sightability, minimal bias, and data comparability among years. Data was recorded on standard data forms, and moose locations were also recorded on 1:63,000 U.S. Geological Survey quadrangle maps. Surveys were not conducted until a minimum snow cover of approximately 12 inches had accumulated. This level of snow cover is important because snow depth influences sightability and moose distribution. Surveys were not completed in the southern TCAs in 2002 due to low snowfall.

We conducted a population estimation survey covering 8390 mi^2 (ADF&G files, Galena, 12 May 2000) in fall 1999 in the northern portion of Unit 24. Data from that survey were analyzed using the Geostatistical Population Estimator method (GSPE; Ver Hoef 2001). Survey techniques were modified from those outlined by Gasaway et al. (1986). An important change from the Gasaway methodology was, instead of geographical land characteristics, a grid system based on latitude and longitude coordinates was used to locate sample units (~5.7 mi^2 in size), with search intensity of ~6 min/mi^2. We also conducted a GSPE population

estimation survey in the southern portion of Unit 24 downstream from the Hogatza River in 2001 (Bryant and Stout 2003).

Twinning surveys were flown in May to determine the proportion of moose calf twins in the TCA. Search and survey techniques and sample units were similar to those used in early winter. Observation of 50 cows with calves was the desired minimum, but funding and weather often prevented us from achieving that goal. Moose were classified as bull, yearling, calf, cow, cow with 1 calf, or cow with 2 calves. The timing of the surveys was critical. The surveys were flown when approximately 50% of the cows observed had calves. We flew at this time to avoid early mortality factors such as black bear predation, which could strongly influence the results.

Hunter harvest was monitored through mandatory moose harvest reports and a moose hunter checkstation operated on the lower Koyukuk River. We encouraged local residents to increase their harvest reporting by providing information at public meetings, checkstations, and village meetings. Hunting mortality and harvest distribution were also monitored through the statewide harvest ticket system, registration permits, drawing permits, and door-to-door subsistence surveys. General season hunters were sent 1 reminder letter to return their harvest reports. Hunters who had harvest permits (drawing and registration hunts) were sent 1 reminder postcard, then called via telephone, and then sent a certified letter. Names of hunters who possessed drawing permits were withdrawn from the following year's drawing permit hunts if no response was received. Information obtained from the reports and surveys was used to determine total harvest, harvest location, hunter residency and success, harvest chronology, and transportation used. Harvest data were summarized by regulatory year (RY), which begins 1 July and ends 30 June (e.g., RY01 = 1 Jul 2001–30 Jun 2002).

Predation was evaluated by interviewing trappers, field observations, and aerial wolf reconnaissance surveys conducted in cooperation with the U.S. Fish and Wildlife Service.

We discontinued the planning effort implemented in 1998 to address concerns over increasing numbers of hunters in the Koyukuk River drainage. The planning process was initiated in winter 1999–2000, and a Koyukuk River Moose Hunters' Working Group (KWG) was formed with representatives from the state’s advisory committees, the federal Western Interior Regional Advisory Council, and local commercial hunting guides. The planning group developed a draft 5-year Koyukuk River Moose Management Plan (ADF&G files) that was submitted to the Alaska Board of Game during its March 2000 meeting. The finalized plan was used as a guide for management goals, objectives, activities, and biological decision-making criteria in this management report, and was endorsed by the Board of Game at its winter 2001 meeting. A public meeting was hosted by the department in January 2004 to update interested individuals concerning the status of activities related to the moose management plan.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Status and trends of the moose population in an area as large and diverse as Unit 24 are difficult to determine with any degree of certainty. Most often, population size is described using generalities, and trends are discernible only for the few areas surveyed.

During RY01–RY02, moose were numerous in the Koyukuk River lowlands in the southern third of the unit (south of Hughes). Based on recruitment parameters, the population probably declined in the Dulbi Slough, Huslia River Flats, and Treat Island areas (Tables 1–3). Moose densities usually exceeded 4 moose/mi^2 in these areas, and although recruitment parameters were generally low, the yearling bull:cow ratios and calf:cow ratios improved from previous surveys. Further upriver, in the Kanuti Canyon, Henshaw/Peavey Creek, and Middle Fork TCAs, moose densities were 0.72, 0.63 and 0.92 moose/mi^2 respectively (Tables 4–6) in RY03. In 2003, yearling bull:cow ratios increased in all 3 TCAs, while calf counts continued to be low.

Population Size

In the RY99–RY00 management report (Stout 2002), the Unit 24 population estimate of 8100 moose ±1350 (6750–9450) was based on population estimation surveys (Martin and Zirkle 1996; Huntington 1998; Woolington 1998), extrapolations (Dale et al. 1995), and the use of trend area data that demonstrated declines in productivity and recruitment parameters. Most of that information was collected during the early and mid 1990s, when the population was high, and the data was collected over relatively small areas within the unit. Recent surveys have helped to refine the overall estimate within the unit and indicate the population estimate in the northern portion of Unit 24 north of Bettles was too high, but the estimate for the far southern portion south of Hughes was low.

The 2001 GSPE survey conducted in the area from Dulbi Slough and the lower Huslia River up to the lower Hogatza River estimated 3642 moose ± 572, not including a sightability correction factor, over a 1949 mi^2 survey block within the Koyukuk CUA. That was higher than the previously reported estimate. Surveys on the upper Huslia, upper Dakli, upper Indian and upper Hogatza River drainages had estimated densities averaging 0.25 moose/mi^2 based on stratified sample units that were considered habitat with low moose density in the 2001 survey. For the total of 6268 mi^2 in that area, I estimated 1567 moose during the current reporting period, which was similar to the previous estimate. The estimate for the 1999 GSPE survey block of 8390 mi^2 was 3036 moose, not including a sightability correction factor (±647, Table 8). Incorporating an estimated decline of 10% based on TCA data, I estimated 2732 moose in that portion of Unit 24 at the end of RY03. Using information collected during a reconnaissance survey in 2003 (ADF&G files, Galena) and data reported by Lawler et al. 2003, I estimated 375 moose in the 5732 mi^2 Gates of the Arctic portion of Unit 24. Extrapolating data from the 2003 GSPE survey conducted in the southern hills of the Brooks Range in Unit 23 (Lawler et al. 2003), I estimated 630 moose (0.20 moose/mi^2) in the remaining 3121 mi^2 of Unit 24 for the upper drainages of the Alatna, John, and Wild Rivers and a small portion of the area south of the 1999 survey block in the upper Kanuti River drainage and east of the Dalton Highway. For the later 2 areas, the estimate was lower than

previously calculated. Therefore, the total Unit 24 population was estimated to be 9120 moose ±1520 (7600–10,640) at the end of RY02.

Although the population estimate for RY01–RY02 increased, it was due to a refinement in the estimate. In fact, during RY01–RY02, recruitment parameters such as calf:cow ratios and yearling bull:cow ratios throughout the area indicated the population was declining, which I believe to be accurate.

Population Composition

Composition data were available from aerial surveys conducted in cooperation with U.S. Fish and Wildlife Service staff from the Koyukuk National Wildlife Refuge and Kanuti National Wildlife Refuge (Tables 1–7). Results from surveys conducted through RY03 were variable. Bull:cow ratios were generally high in the Huslia River Flats and Henshaw–Peavy Creek TCAs and on the Kanuti Refuge. However, the Dulbi Slough, Treat Island, Kanuti Canyon, and Middle Fork TCAs' bull:cow ratios were typically lower than the broader area, as estimated by the population estimation surveys. I believe this is mostly explained by the influence of hunting pressure in these relatively higher density moose areas. The higher density moose areas typically attracted higher levels of hunting pressure and are generally more accessible. Franzmann and Schwartz (1998) suggested a ratio of 20–30 bulls:100 cows is needed to ensure breeding of all available cows, indicating normal breeding activity was unaffected. Ratios for RY01–RY02 in the Middle Fork TCA were questionable due to small sample size. In general, most ratios in the TCAs with counts of less than 100 moose tended to have larger variations that made interpretation more tenuous.

Calf twinning rates in spring 2003 and 2004 suggested improved productivity in Unit 24 (Table 9) in the Huslia Flats–Treat Island TCAs. We suggest this improvement is related to the 3 to 4 prior consecutive mild winters and the corresponding length of the intervening snow free seasons. Although no objective measurements of habitat were conducted during this period, I observed no dramatic changes in vegetative characteristics that would account for the apparent improvements in twinning rates. Thus, I do not believe a density-dependent effect was acting on the population because twinning rates declined only temporarily while the moose population maintained relatively high and stable densities.

Distribution and Movements

Little date is available on movements of moose within the unit. Thirteen moose radiocollared in winter 1984–1985 in northern Unit 21D migrated into the southwestern parts of Unit 24 during each summer. Generally, moose are found at treeline in the northern part of Unit 24 in early winter and move into the river bottoms during late winter and summer. In the southern portion of the unit, moose occupy the broad riparian habitats year-round with much shorter seasonal migrations.

MORTALITY

Harvest

Season and Bag Limit.

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
Unit 24, that portion within the Koyukuk Controlled Use Area.		
RESIDENT HUNTERS: 1 moose per regulatory year, only as follows:		
1 moose by registration permit only;	27 Aug–31Aug (Subsistence hunt only)	
or		
1 bull by registration permit only;	1 Sep–20 Sep (Subsistence hunt only)	
or		
1 bull by drawing permit only; up to 320 permits may be issued in combination with Unit 21D that portion within the Koyukuk Controlled Use Area; or	5 Sep–25 Sep (Subsistence hunt only)	
1 moose.	1 Dec–10 Dec 1 Mar–10 Mar (Subsistence hunt only)	5 Sep–25 Sep
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side by drawing permit; up to 80 permits may be issued in combination with Unit 21D, that portion within the Koyukuk Controlled Use Area.		
Unit 24, that portion of the John and Alatna River drainages within the Gates of the Arctic National Park.		
1 moose.	1 Aug–31 Dec	No open season
Unit 24, all drainages to the north of the North Fork Koyukuk River drainage within the Gates of the Arctic National Park.		

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
1 moose	1 Sep–25 Sep 1 Mar–10 Mar	No open season
Unit 24, all drainages to the north of the Koyukuk River upstream from the Henshaw Creek drainage, to and including the North Fork Koyukuk River, except that portion of the John River drainage within Gates of the Arctic Park.		
RESIDENT HUNTERS: 1 moose; however, antlerless moose may be taken only during the period 21 Sep–25 Sep.	1 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep
Unit 24, all drainages to the north of the Koyukuk River between and including the Alatna River and Henshaw Creek drainages, except that portion of the Alatna River drainage within Gates of the Arctic National Park.		
RESIDENT HUNTERS: 1 moose; however, antlerless moose may be taken only during the periods 21 Sep–25 Sep and 1 Mar–10 Mar.	1 Sep–25 Sep 1 Mar–10 Mar	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep
Unit 24, that portion in the Dalton Highway Corridor Management Area.		
RESIDENT HUNTERS: 1 bull by	1 Sep–25 Sep	

Units and Bag Limits	Resident Open Season (Subsistence and General Hunts)	Nonresident Open Season
drawing permit; up to 70 permits may be issued in combination with Unit 25A, that portion within the Dalton Highway Corridor Management Area.		
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side by drawing permit only; up to 70 permits may be issued in combination with Unit 25A, that portion within the Dalton Highway Corridor Management Area.		5 Sep–25 Sep
Remainder of Unit 24.		
RESIDENT HUNTERS: 1 bull.	1 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on 1 side.		5 Sep–25 Sep

Alaska Board of Game Actions and Emergency Orders. Subsistence and general registration hunts were established in the Koyukuk CUA downstream of Huslia by the Board of Game in March 1996 to counter a moose hunting closure by the Federal Subsistence Board. The federal board closed federally managed lands within one-half mile of the Koyukuk River in nearby Unit 21D from the Kateel River to 40 miles upstream from the mouth of the Koyukuk for all but local rural residents. This closure was prompted by perceived declines in moose availability for local residents and by an increase in moose hunters. Two separate registration hunts were established. A subsistence registration hunt was opened to all Alaska residents during 1 September–25 September, with a bag limit of 1 moose. All the meat had to remain on the bones, the head had to be salvaged, and the antlers were cut to destroy the trophy value. A general registration hunt was opened to all hunters during 5 September–25 September, with a bag limit of either 1 antlerless moose or 1 bull with antlers at least 50 inches wide, or at least 4 brow tines on at least 1 side. Seasons and bag limits for the remainder of the unit were unchanged.

Several changes were made to the regulations during the 2000 and 2002 Board of Game meetings, due mostly to recommendations proposed by the KWG. Foremost among the changes was implementation of limited drawing hunts for the Koyukuk Controlled Use Area in RY00 and for the Dalton Highway Corridor Management Area in RY02. In RY00 the

antlerless moose season for the general season drawing hunts, formerly RM830, was closed, and the antlerless season for the subsistence registration hunt RM832 was reduced to the first 5 days of the season. The RM832 hunt was also shifted forward 5 days so it opened on 27 August and closed on 20 September. Additional restrictions applied by department discretionary authority required hunters to saw through the middle of the palm of one of the antlers of bulls harvested under a RM832 permit. In RY00 and RY01 an emergency order closed the March season in the area north of the Koyukuk River between the Alatna and North Fork Rivers. Unexpected increases in hunter participation made it necessary to close that season early because of the excessive harvest of the relatively low number of moose in that area, especially in the lower portion of the Wild River drainage. In RY02–RY03, fall antlerless moose seasons in Unit 24 were closed by emergency order due to concerns over continued declines in recruitment parameters.

At the 2004 Board of Game meeting, drawing and registration hunts during the fall season were expanded to drainages surrounding the Koyukuk Controlled Use Area. The new hunts were adopted by the board to respond to the concentration of hunters around the perimeter of the CUA and to improve success rates of local hunters during the fall hunting seasons so they would be less dependent on winter hunts. A large proportion of the moose harvested during the winter seasons have been cows. March seasons were also closed and replaced with a bulls-only December season.

Hunter Harvest. Hunting seasons in the unit were diverse and reflected various moose densities and consumptive use patterns. Annual reported harvest during RY93–RY02 averaged 190 moose (142–240, Table 10).

Illegal and unreported harvests by local residents continued to hamper department efforts to manage moose. During some years, actual harvest was estimated to be about twice the reported harvest (Table 10). Moose taken during winter were rarely reported, even when the season was open. Several villages have never had a license vendor. This contributed to the problem of hunters hunting without licenses or harvest tickets. Checkstation results, including the meat evaluation survey and the hunter viewing survey, can be found in the RY01–RY02 Unit 21D Moose Management Report (Stout 2004).

Harvest Chronology. Over 95% of reported harvest occurred in the September seasons (Table 11). However, much of the unreported harvest probably occurred during October–March (Anderson et al. 1998).

Permit Hunts. Beginning in RY00 in the Koyukuk CUA, drawing permit hunts DM827, DM828, DM829, and DM830 replaced the general registration permit RM830. Either subsistence registration permit RM832 or one of the drawing permits were required for the fall hunt in the Koyukuk CUA. The number of RM832 permits issued for RY02 decreased by 10.9% from RY01 and then increased by 11.7% in RY03 (Table 12). So it appears that use of the RM832 permit has stabilized. Use of the registration permit increased among Unit 21D residents while other Alaska residents' use of the permit was down somewhat. Increases in the number of Alaska resident hunters using the subsistence permit alternative and the potential to exceed the sustainable yield of the moose population has been a critical

management issue. With the implementation of the 4 drawing hunts, DM827, DM828, DM829 and DM830, hunter numbers can be better regulated.

Within the DHCMA, drawing permit hunts DM920 and DM922 resulted in a reduction of moose harvested compared to harvest under the general harvest ticket. Rates for successfully drawing a DHCMA permit were relatively high in RY02–RY03, at 19.2% for DM920 and 33.1% for DM922. However, hunting success rates among the permitted hunters was low at 0% north of Slate Creek (DM920) and an average of 13% south of Slate Creek (DM922) (Table 13). Hunter comments about the new permit hunts were positive in terms of the aesthetics of the hunt, but often negative among the hunters if they were unable to successfully draw a permit.

Hunter Residency and Success. Based on harvest reports, there was an average of 361 moose hunters during RY93–RY03, the majority of whom were Alaska residents (Table 14). The number of hunters was probably underreported because Unit 24 residents often did not report unsuccessful hunt information. Harvest and hunter participation by Unit 24 residents was relatively constant, according to Division of Subsistence surveys (Anderson et al. 1998). However, nonresident and nonlocal resident hunter participation increased steadily since RY88. The increase in nonlocal hunters created tension among user groups and was the impetus for creating the KWG.

The estimated annual harvest by residents of Unit 24 was about 172 moose, according to Marcotte (1986) and Marcotte and Haynes (1985). They estimated residents of Huslia, Hughes, Allakaket–Alatna, Bettles, and Wiseman annually took 84, 33, 35, 10, and 5 moose, respectively. I estimated an additional 5 moose taken by unit residents not living in a village. Data reported by Anderson et al. (1998) was similar to earlier results. The estimated unreported harvest incorporated recent Subsistence Division data, less the reported harvest by unit residents (Table 10).

Transportation Methods. In RY01–RY03, boats continued to be the primary transportation method in Unit 24 because of the extensive river system, lack of roads, and restrictions on the use of aircraft within the 2 CUAs (Table 15). Highway vehicles were only used on the Dalton Highway where it crosses the eastern part of the unit. Snowmachines were the main transportation method used during the winter.

The Dalton Highway was closed to the public at the Yukon River Bridge after construction was completed, but was opened to public use throughout Unit 24 in 1981. The number of hunters and moose harvest for hunters accessing Unit 24 by the Dalton Highway during RY02–RY03 declined by more than 50% after implementation of permit hunts DM920 and DM922 (Table 13).

Other Mortality

A minimum of 400–440 wolves in 55–60 packs and a large population of black bears inhabit the middle and southern portions of the unit. Grizzly bears are common throughout the montane areas. Predation on moose was thought to be high, keeping the moose population low throughout much of the central portion of the unit.

HABITAT

Assessment

No habitat assessment work was conducted during this reporting period.

MANAGEMENT PLANNING

The KWG was essentially disbanded in RY02, due to the turnover of advisory committee membership. The plan was the basis for developing goals and activities for moose management in Unit 24. Although the KWG's area of concern was specifically within the Koyukuk River drainage, the issues were characteristic of concerns throughout Unit 24 and nearby Unit 21D. One public meeting was hosted by the department in January 2004 to provide an update on the status of management related activities outlined in the moose management plan.

CONCLUSIONS AND RECOMMENDATIONS

Unit 24 is larger than some states, with a wide range of habitats available to moose. Moose densities range from quite high in small portions of the unit to the typical low densities expected in large areas of rural Interior Alaska. Hunting activity was typically concentrated in areas accessible by boat, with the potential for creating conflicts between local subsistence hunters and nonlocal hunters. Conflicts between user groups, whether real or perceived, have the potential to greatly affect future management decisions.

Habitat was excellent throughout much of the unit, with an abundance of successional willow regrowth due to either fire or riverine erosion. Availability of browse was not limiting the moose population during the report period.

With the exception of limited areas around Allakaket, Bettles, and Huslia, predation on moose by wolves and bears was likely the major factor limiting Unit 24 moose populations. Unit residents met their wild food requirements, but hunting opportunities cannot be expanded for people living outside the unit until moose numbers increase. Where predators have been lightly harvested for long periods, predation seems to keep moose densities low (0.1–1.1 moose/mi^2 in areas >800 mi^2, Gasaway et al. 1992).

We still need to obtain population estimates for the Hogatza River, upper Huslia River, and Indian River drainages and the northern portion of Unit 24, including Gates of the Arctic National Park. A population estimation survey should be undertaken in cooperation with National Park Service when funding is available. Trend data should also be collected in popular hunting areas such as the South Fork Koyukuk River upstream from the Dalton Highway, Alatna River, John River, and Kanuti River areas.

For the first goal concerning harvest within sustained yield principles, my estimated population of 9120 moose, not including a sightability correction factor, did not achieve the objective to maintain a population of 10,000–12,000 moose for the second consecutive reporting period. We achieved the objective to provide for an adequate moose harvest without exceeding 360 moose or a 5% harvest rate. We also achieved the objective to provide for hunting opportunity that did not exceed 500 hunters.

The long-term objective of implementing at least 2 habitat enhancement activities was not achieved directly during RY01–RY02, but coordination with the U.S. Fish and Wildlife Service concerning potential treatment is in progress. The objective of reducing spoiled meat was monitored in RY02 and RY03. I believe regulations adopted by the board that required meat to remain on the bone on all 4 quarters and the ribs in all of Unit 24 was a positive move toward achieving this objective. We also developed a program at the Ella's cabin checkstation to establish baseline meat salvage data for fall hunters. Finally, as with the previous objective, a monitoring program to evaluate the number of people engaged in nonconsumptive activities was developed and baseline data was collected.

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TABLE 1 Unit 24 Dulbi Slough aerial moose composition counts, regulatory years 1982–1983 through 2001–2002

Regulatory year	Survey area (mi^2)	Bulls:100 Cows	Yearling bulls:100 cows	Calves:100 cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1982–1983	35.0	45	5	7	0	4.5	111	3.2
1983–1984	39.0	17	8	33	14	22.5	113	2.9
1984–1985	48.1	19	8	20	6	14.6	130	2.7
1985–1986	54.2	19	9	10	0	7.7	170	3.1
1989–1990	48.7	53	7	23	18	13.1	298	6.1
1996–1997	86.4	24	8	37	1	23.0	443	5.1
1999–2000	89.0	11	3	22	5	16.1	411	4.6
2001–2002	89.0	18	7	25	0	17.4	327	3.6

TABLE 2 Unit 24 Huslia River Flats aerial moose composition counts, regulatory years 1983–1984 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1983–1984	80.0	36	7	23	3	14.6	212	2.7
1985–1986	64.5	45	17	10	25	6.7	254	3.9
1989–1990	38.2	50	2	30	7	16.7	90	2.4
1993–1994	80.2	81	15	24	8	11.8	483	6.0
1997–1998	80.2	58	15	24	9	13.2	438	5.5
2000–2001	80.2	35	3	17	4	11.2	259	3.2
2001–2002	80.2	44	7	14	0	8.7	378	4.7
2003–2004	80.2	42	11	29	3	16.9	354	4.4

TABLE 3 Unit 24 Treat Island aerial moose composition counts, regulatory years 1985–1986 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins:100 cows with calves	Percent calves	Moose	Moose/mi^2
1985–1986	41.0	35	13	17	5	10.9	192	4.7
1993–1994	40.3	39	11	25	7	15.1	317	7.9
1998–1999	67.1	25	6	19	2	13.5	379	5.7
1999–2000	67.1	21	5	15	11	10.8	279	3.6
2000–2001	67.1	16	4	13	5	10.0	430	5.6
2001–2002	67.1	32	4	12	4	8.4	321	4.3
2003–2004	67.1	22	9	20	9	14	338	5.0

TABLE 4 Unit 24 Henshaw–Peavy Creek aerial moose composition counts, regulatory years 1991–1992 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1991–1992	67	80		30		14	42	0.62
1992–1993	67	58	11	5		3	64	0.85
2000–2001	106	129	18	24	67	9	43	0.41
2001–2002	106	106	0	31	0	13	38	0.36
2002–2003	106	72	6	28	0	14	36	0.34
2003–2004	106	68	15	29	22	15	67	0.63

TABLE 5 Unit 24 Kanuti Canyon aerial moose composition counts, regulatory years 1988–1989 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1988–1989	96	118		41		16	101	1.05
1992–1993	79	77	8	27		1	106	1.34
2000–2001	86	38	7	7	0	5	87	1.01
2001–2002	86	40	9	23	0	14	57	0.66
2002–2003	86	16	4	13	0	10	72	0.84
2003–2004	86	29	11	9	0	6	62	0.72

TABLE 6 Unit 24 Middle Fork aerial moose composition counts, regulatory years 1988–1989 through 2003–2004

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1987–1988	78.1	49	5	21	0	13	104	2.16
2000–2001	77	13	0	43	10	27	62	0.81
2001–2002	77	36	9	18	0	12	34	0.44
2002–2003	77	0	0	33	0	25	24	0.31
2003–2004	113	23	9	24	0	16	104	0.92

TABLE 7 Unit 24 Kanuti National Wildlife Refuge population estimation surveys, regulatory years 1989–1990 through 1999–2000

Regulatory year	Survey area (mi^2)	Bulls:100 cows	Yearling bulls:100 cows	Calves:100 cows	Twins/100 cows with calves	Percent calves	Moose	Moose/mi^2
1989–1990[a]	2615	64	4.1	16.5	n/a	9.2	1172 (878–1467)	0.45
1993–1994[a]	2644	61	8.0	33.0	n/a	17.0	2010 (1716–2304)	0.76
1999–2000	2714	61	4.3	27.8	n/a	14.7	1188 (879–1497)	0.39

[a] Martin and Zirkle 1996.

TABLE 8 Unit 24 population estimation survey summaries, regulatory years 1989–1990 through 1999–2000[a]

Survey area	Area mi^2	Total sample units	Bulls:100 Cows	Calves:100 Cows	Population estimate
Management Zone 1 - **Subtotal**	4696				4000 ± 500
Management Zone 2					
1999 Survey block	8390	1585	65:100	28:100	3036 ± 647 (90% CI)
Moose habitat Unit 24/North[b]	4752		65:100	28:100	1720 ± 353
Remainder Unit 24/North[c]	8217		65:100	28:100	244 ± 50
Subtotal	21,359				5000 ± 1050
Unit 24 – **Total**	26,055				9000 ± 1500

[a] Stout 2000.

[b] The estimated area of Unit 24 that could potentially support moose year-round.

[c] The area remaining in Unit 24 with very little year-round moose habitat, primarily the high altitude mountainous portion within Gates of the Arctic National Park.

TABLE 9 Unit 24 moose aerial twinning surveys in the combined areas of Huslia Flats and Treat Island trend count areas, regulatory years 2001–2002 through 2003–2004

Regulatory year	Cows w/o calves	Cows w/1 calf	Cows w/twins	Twinning %[a]	Yearlings	Dates
2001–2002	--	17	2	11	3	29 May–1 Jun
2002–2003	144	53	22	29	41	28–30 May
2003–2004	58	55	23	29	34	29 and 30 May

[a] Percent of cows with calves that had twins.

TABLE 10 Unit 24 moose hunter harvest, regulatory years 1988–1989 through 2003–2004

Regulatory	Harvest by hunters				Unreported	
Year	Bull	Cow	Unk	Total	harvest	Total
1988–1989	132	5	0	137	131	268
1989–1990	119	8	1	128	132	260
1990–1991	141	2	1	144	129	273
1991–1992	141	2	1	144	129	273
1992–1993	118	5	0	123	124	247
1993–1994	139	12	0	151	116	267
1994–1995	134	8	0	142	135	277
1995–1996	161	8	0	169	129	298
1996–1997	176	14	0	190	117	307
1997–1998	168	10	2	180	100	280
1998–1999	213	17	0	230	100	330
1999–2000	228	10	2	240	100	340
2000–2001	211	7	1	219	100	319
2001–2002	183	5	1	189	100	289
2002–2003	186	4	0	190	100	290
2003–2004[a]	149	5	1	155	100	255

[a] Preliminary data.

TABLE 11 Unit 24 moose harvest chronology percent by month/day, regulatory years 1996–1997 through 2003–2004

Regulatory	Harvest chronology percent by month/day				
year	9/1–9/14	9/15–9/25	12/1–12/10	3/1–3/10	*n*
1996–1997	48	46	2	5	187
1997–1998	49	46	1	4	170
1998–1999	49	47	0	5	219
1999–2000	43	52	0	4	231
2000–2001	46	49	0	4	205
2001–2002	37	60	2	2	179
2002–2003	43	55	0	2	174
2003–2004[a]	48	48	0	5	145

[a] Preliminary data.

TABLE 12 Units 21D and 24 Koyukuk Controlled Use Area moose harvest by permit hunt, regulatory years 1998–1999 through 2003–2004[a]

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
RM832	1998–1999	295	8	45	55	125 (77)	38 (23)	0	163
	1999–2000	356	9	49	51	127 (70)	54 (30)	1	182
	2000–2001	355	14	45	55	157 (93)	11 (7)	1	169
	2001–2002	403	15	62	38	126 (97)	3 (2)	1	130
	2002–2003	359	17	51	49	145 (100)	0 (0)	0	145
	2003–2004	401	12	55	45	155 (99)	0 (0)	2	157
RM830	1998–1999	330	5	45	55	159 (87)	23 (13)	0	182
	1999–2000	380	3	51	49	148 (79)	39 (21)	0	187
DM827	2000–2001	26	19	52	48	10 (100)	0 (0)	0	10
	2001–2002	26	19	68	32	5 (83)	1 (17)	0	6
	2002–2003	20	35	31	69	9 (100)	0 (0)	0	9
	2003–2004	26	19	63	37	7 (100)	0 (0)	0	7
DM828	2000–2001	103	51	22	78	38 (100)	0 (0)	0	38
	2001–2002	103	63	54	46	17 (100)	0 (0)	0	17
	2002–2003	79	56	45	55	17 (100)	0 (0)	0	17
	2003–2004	103	48	40	60	27 (100)	0 (0)	0	27
DM829	2000–2001	26	15	27	73	16 (100)	0 (0)	0	16
	2001–2002	26	15	50	50	8 (100)	0 (0)	0	8
	2002–2003	20	45	0	100	11 (100)	0 (0)	0	11
	2003–2004	26	12	38	62	13 (100)	0 (0)	0	13
DM830	2000–2001	103	41	25	75	45 (100)	0 (0)	0	45
	2001–2002	103	51	43	57	26 (100)	0 (0)	0	26
	2002–2003	79	38	16	84	41 (100)	0 (0)	0	41
	2003–2004	103	36	24	76	44 (100)	0 (0)	0	44

Table 12 continued

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
Total	1998–1999	625	7	41	59	284 (82)	61 (18)	0	345
	1999–2000	736	5	46	54	275 (75)	93 (25)	1	369
	2000–2001	613	25	39	61	266 (96)	11 (4)	1	278
	2001–2002	661	29	59	41	182 (97)	4 (2)	1	187
	2002–2003	557	27	46	54	217 (100)	0 (0)	1	218
	2003–2004	659	22	50	50	246 (99)	0 (0)	2	248

[a] RM830 ended in regulatory year 2000–2001 and was replaced by Drawing Hunts DM827, 828, 829, and 830.

TABLE 13 Unit 24 Dalton Highway Corridor Management Area moose harvest by permit hunt, regulatory years 2002–2003 through 2003–2004

Hunt	Regulatory year	Permits issued	Percent did not hunt	Percent unsuccessful hunters	Percent successful hunters	Bulls (%)	Cows (%)	Unk	Total harvest
DM920	2002–2003	20	30	100	0	0 (0)	0 (0)	0	0
	2003–2004	20	40	100	0	0 (0)	0 (0)	0	0
DM922	2002–2003	50	29	88	12	4 (100)	0 (0)	0	4
	2003–2004	50	54	86	14	3 (100)	0 (0)	0	3

TABLE 14 Unit 24 moose hunter residency and success, regulatory years 1988–1989 through 2003–2004

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total	Local[a] resident	Nonlocal resident	Nonresident	Unk	Total	
1988–1989	41	57	16	23	137	13	63	18	25	119	256
1989–1990	40	68	17	3	128	28	107	16	4	155	283
1990–1991	43	71	22	8	144	17	81	16	9	123	267
1991–1992	43	77	23	1	144	14	138	16	3	171	315
1992–1993	48	62	7	6	123	27	129	27	3	186	309
1993–1994	56	68	25	2	151	24	94	23	1	142	293
1994–1995	37	78	25	2	142	10	90	21	3	124	266
1995–1996	43	97	30	0	170	12	93	18	0	123	293
1996–1997	55	95	38	2	190	24	98	26	0	148	338
1997–1998	40	97	41	2	180	18	81	20	0	119	299
1998–1999	41	125	59	5	230	20	120	25	2	167	397
1999–2000	40	119	77	4	240	25	143	39	3	210	450
2000–2001	57	124	38	1	220	36	141	55	0	232	452
2001–2002	32	101	48	1	182	20	181	57	0	258	440
2002–2003	32	90	68	0	190	26	130	56	2	214	404
2003–2004[b]	36	76	35	8	155	20	104	50	10	184	339

[a] Unit resident only.
[b] Preliminary data.

TABLE 15 Unit 24 moose harvest percent by transport method, regulatory years 1988–1989 through 2003–2004

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1988–1989	23	1	49	1	0	3	13	9	137
1989–1990	19	1	44	1	1	1	24	9	140
1990–1991	16	3	56	3	1	2	16	3	144
1991–1992	25	2	44	3	1	2	17	5	144
1992–1993	16	0	56	3	5	1	13	6	123
1993–1994	15	0	60	6	5	2	7	4	151
1994–1995	17	2	53	3	5	3	12	4	142
1995–1996	13	2	59	2	6	2	15	2	170
1996–1997	12	1	62	3	6	1	13	4	190
1997–1998	19	1	51	7	6	1	11	6	178
1998–1999	17	0	62	2	4	0	10	5	230
1999–2000	17	1	56	3	4	0	18	1	240
2000–2001	16	0	61	3	4	1	14	2	220
2001–2002	19	1	62	2	3	0	14	0	182
2002–2003	18	1	69	1	2	0	7	2	190
2003–2004[a]	19	1	69	1	5	0	5	1	155

[a] Preliminary results.

WILDLIFE MANAGEMENT REPORT

Alaska Department of Fish and Game
Division of Wildlife Conservation
(907) 465-4190 PO BOX 25526
JUNEAU, AK 99802-5526

MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNITS: 25A, 25B, and 25D (47,968 mi^2)

GEOGRAPHIC DESCRIPTION: Upper Yukon River Valley

BACKGROUND

Historically, moose have been relatively scarce in the upper Yukon River valley. Long-time residents of the area report moose were hard to find in the early 1900s, but were more common in recent years (F. Thomas, H. Petersen, K. Peter, personal communication). However, moose density continues to be low compared with many other areas in Interior Alaska. A few population surveys were done in the late 1970s, and more extensive surveys began in 1981 when the Alaska Department of Fish and Game (ADF&G) established a Fort Yukon area office. Estimates of population density in survey areas on the Yukon Flats in Unit 25D have ranged from a low of 0.1 moose/mi^2 in the west in 1984 to 0.64 moose/mi^2 in the east in 1989 (ADF&G files). Extrapolations from trend surveys and stratification efforts resulted in estimates of 1253 moose in 1984 and 2000 moose in 1989 in a 5400-mi^2 area in Unit 25D East (Maclean and Golden 1991). Survey techniques have been modified to reflect advances in sampling techniques and to accommodate the area's relatively low moose density.

Population surveys and observations by local residents suggest that moose numbers increased somewhat during the 1970s and 1980s in Unit 25D. Trend counts and population estimates, as well as anecdotal information, indicate moose numbers were stable or declining in Unit 25D West and declining in Unit 25D East during the 1990s. Numbers currently appear to be declining in both areas. Moose densities continue to be low compared to other areas in Alaska, making it difficult to simplify regulations.

Recent population trends in Units 25A and 25B are not well understood. Composition surveys were last conducted in Unit 25B in 1987. Reports from experienced guides and pilots indicate moose numbers in Unit 25B have declined and are currently at a low level. Population surveys in Unit 25A suggest that numbers have also declined in this area during the past decade.

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

Based on knowledge of wolf numbers and food habits and moose mortality studies, limiting factors include predation by black bears, grizzly bears and wolves, as well as hunting. A recent moose calf mortality study showed that predation by black bears and grizzly bears is the major cause of calf moose mortality during summer (Bertram and Vivion 2002). During 1999 and 2000, 30 radiocollared cows and their calves were monitored over a 2-year period in Unit 25D West. The results showed that only about 20% of calves born survived until 30 November. Major sources of mortality included black bears (45%), brown bears (39%), wolves (3%), drowning (8%), and abandonment (5%). Average annual survival of adult cows averaged 88%. In the first year, 2 cows were killed by brown bears and 1 was killed illegally by a hunter. Four were killed by wolves during the second year. The pregnancy rate was 89%, and 63% of the cows had twins. Vegetation surveys indicate that moose browse is abundant and browsing intensity is low (ADF&G, unpublished data; C. Fleener, personal communication). The area is characterized by low to moderate snowfall.

Unit 25D was divided into Units 25D West and 25D East in the early 1980s to allow the use of regulatory schemes that reflected the different status of moose populations. The boundary between the 2 areas lies along Preacher and Birch Creeks south of the Yukon River and along the Hadweenzic River north of the Yukon. Low moose density in Unit 25D West, combined with the relatively high demand for moose by local residents, resulted in the use of permit systems that limited hunting largely to residents of the area.

A registration permit hunt was established in Unit 25D West in 1983, with a bag limit of 1 bull and a 25 August–5 October open season. Sixty permits were issued to residents of the 3 communities in the area. The fall season was shortened and 2 winter hunting periods were added in 1984. A harvest quota of 35 bull moose was established in 1986. A Tier II permit hunt was established in regulatory year (RY) 1990 because the harvestable surplus was deemed insufficient to support all subsistence uses, and restrictions were thought to be necessary (RY = 1 Jul–30 Jun, e.g., RY90 = 1 Jul 1990–30 Jun 1991).

A harvest quota of 35 bull moose was established in Unit 25D West in 1986. Since 1990, moose have been hunted under a Tier II permit system with up to 125 Tier II permits issued each year. In 1990 the Federal Subsistence Board promulgated regulations for subsistence use on federal lands. These regulations took effect 1 July 1991, when a federal subsistence moose permit system was established in Unit 25D West. It provided an unlimited number of permits to residents of the 3 communities in Unit 25D West to hunt bull moose on federal lands. The state Tier II permit system remained in effect and applied to both private and federal lands. A maximum of 30 federal permits and 125 state Tier II permits were issued each year beginning in 1993. In 1993 there also was a change in the way regulations were applied in Unit 25D West. Federal permits were required on federal land and were issued only to residents of the 3 communities in the unit. However, state Tier II permits issued to residents of Unit 25D West were again recognized as valid on federal lands beginning in 2000, when 60 federal and 75 state Tier II permits were available, with a harvest quota of up to 60 bull moose.

Dual management also affected regulations in Units 25A, 25B, and 25D East. Seasons for eligible local residents hunting on federal land were longer (generally 25 Aug–25 Sep and

1 Dec–20 Dec) than the state season. The state season applied to all hunters on private and state lands and to nonlocal hunters on federal lands.

The cumulative effect of various annual permit application requirements, confusion over geographic boundaries, and other circumstances have resulted in low reporting and limited participation in the harvest management system. Discussions with local residents during 1999 helped identify a number of steps that could improve moose management on the western Yukon Flats. They included revising the harvest quota for moose, reducing the maximum number of Tier II permits available, and aligning state and federal hunting seasons.

A study of local opinions on moose management issues in Fort Yukon during 1995–1996 indicated there was substantial concern about the status of moose populations, opposition to the taking of cow moose, and support for increased enforcement, biological studies, predator control and local involvement in moose management (C. Fleener, unpublished report).

In March 2000 the Alaska Board of Game lengthened the state season in Unit 25D West to 25 August–28 February, aligning it with the season on federal public lands, and agreed with the department's recommendations to increase the harvest guideline from 35 to 60 bull moose and reduce the number of Tier II permits available from 125 to 75. A proposal to include a maximum of 20 cow moose in the harvest quota was not approved by the board. The board also approved a regulation that established a Community Harvest Permit program for part of Unit 25D East, under which individual bag limits could be pooled so more than 1 moose could be taken by an individual hunter. The board established the Chalkyitsik Community Harvest Area and a community harvest bag limit for moose in the portion of Units 25D and 25B included in the community harvest area.

In early 2001 the department initiated a cooperative effort to develop a moose management plan for the Yukon Flats. In 2002 the Yukon Flats Cooperative Moose Management Plan was completed, and it was endorsed by the Board of Game. The plan was developed under the sponsorship of the Alaska Department of Fish and Game/Division of Wildlife Conservation, in cooperation with the Yukon Flats Fish and Game Advisory Committee through the Yukon Flats Moose Management Planning Committee, a temporary group created specifically for the planning project. Other stakeholders involved in the project include the Council of Athabascan Tribal Governments, individual tribal governments, the U.S. Fish and Wildlife Service (FWS)/Yukon Flats National Wildlife Refuge, the FWS/Office of Subsistence Management and other interested users of the Yukon Flats moose resource. This effort focused on community and agency initiatives that together could maintain or increase moose abundance, especially in key hunting areas near local communities, as well as the interest of nonlocal hunters and other interested parties. The Yukon Flats Cooperative Moose Management Plan was designed to promote increasing the Yukon Flats moose population in the following ways: 1) improve moose harvest reporting to better document subsistence needs and improve management; 2) reduce predation on moose by increasing the harvest of bears and wolves; 3) minimize illegal cow moose harvest and reduce harvest of cows for ceremonial purposes so that more calves are born; 4) inform hunters and others about the low moose population on the Yukon Flats and ways people can help in the effort to increase moose numbers; and 5) use both scientific information and traditional knowledge to help make wise management decisions. Management goals and objectives have been revised to

incorporate goals and objectives developed by the Yukon Flats Moose Management Planning Committee.

MANAGEMENT GOALS

Unit 25 Overall

- Protect, maintain, and enhance the moose population and its habitat in concert with other components of the ecosystem.

Unit 25A

- Provide an opportunity to hunt under aesthetically pleasing conditions and provide for subsistence use.

Units 25B and 25D

- Provide for subsistence use and for the greatest opportunity to harvest moose.

- Protect, maintain, and enhance the Yukon Flats moose population and habitat, maintain traditional lifestyles and provide opportunities for use of the moose resource.

- Increase the harvestable surplus of bull moose in key hunting areas near local communities by reducing mortality from bear and wolf predation.

MANAGEMENT OBJECTIVES

Unit 25 Overall

- Double the size of the moose population in key hunting areas and, if possible, within the entire planning area, in the next 10 years. A secondary objective is to increase the number of moose in Unit 25D from 4000 moose to 8000 by 2012.

- Maintain a minimum of 40 bulls per 100 cows as observed in fall surveys.

- Improve moose harvest reporting to attain 90% or greater reporting compliance during the next 3 years.

- Minimize cow moose harvest while the population is rebuilding, recognizing that some cows will probably be taken for ceremonial purposes when bull moose are in poor condition.

ACTIVITIES

- Continue efforts to communicate with and educate local residents about moose management and the effects of cow moose harvest.

- Work with natural resource offices in local communities to obtain and exchange information on moose populations and management issues.

- Develop cooperative management programs involving state, federal, and tribal management organizations to help improve local harvest monitoring and reporting.

- Monitor moose population status through annual surveys.

METHODS

A moose population survey (Gasaway et al. 1986) was conducted in November 1992 in Unit 25D West using multiple PA-18 aircraft and a C-185 for stratification. Population surveys using similar techniques, including regression analysis (J. Ver Hoef, ADF&G, personal communication), were conducted in Unit 25D West in 1996, 1999, 2000, and 2001, spring 1999, 2003 and 2004, and in Unit 25D East in fall 1995, 1997, 1999, 2000 and 2001 and spring 2004. A lack of snow precluded fall surveys in 2002 and 2003. Ninety percent confidence intervals were calculated for most estimates. Beginning in 1999, population surveys were conducted using a spatial analysis technique referred to as the Geostatistical Population Estimator (GSPE), recently developed by Ver Hoef (2001). A sightability correction factor (SCF) has not yet been developed for this technique, but an SCF was applied to survey estimates prior to 1999. Previous studies of sightability indicate that current survey techniques underestimate the number of moose by about 5–15% in most Interior habitats (ADF&G, unpublished data), and recent survey estimates may be revised upward in the future after an SCF is developed for the GSPE survey method. Survey areas were stratified according to moose density using C-185 or C-206 aircraft. Randomly selected sample units were counted with PA-18 or Scout aircraft flown at 70 miles per hour about 500 feet above ground level. We circled moose to determine sex, age, and antler size of bulls, and to locate other moose. Moose habitat in established count areas or sample units was searched systematically at an intensity of at least 4 minutes/mi^2. Sex and age composition observed during trend surveys is presented, as well as observed and estimated sex and age composition based on data collected during population surveys. Population sex and age composition were estimated using statistical and spatial analyses based on bull:cow, calf:cow, and yearling bull:cow ratios observed in different density strata and the area extent of each strata (Ver Hoef 2001). Population surveys in Unit 25A involved counting discrete survey areas that encompassed the major moose habitat in a large area in the eastern part of the unit.

Harvest reports provided information on hunter effort, residency, success, transportation, and antler size. Harvest data were summarized by regulatory year. Informal visits and interviews with area residents provided additional insight into hunter effort and concerns about moose management issues.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

Units 25A and 25B. A population survey was completed in eastern Unit 25A in fall 2000 (Arctic National Wildlife Refuge, unpublished data). The survey area was identical to that used in 1989 and 1991, and survey conditions were excellent. The number of moose observed was about 50% lower than in the 1989 and 1991 surveys, suggesting that moose numbers declined during the last decade (Table 1). Reports from some knowledgeable observers indicate moose numbers in southern Unit 25A also declined during this period. No population surveys were completed in Unit 25B during RY99–RY02. Reports from hunters in Unit 25B indicate that moose have declined south of the Porcupine River and in the upper Black River drainage, and are also relatively scarce north of the Porcupine River. Surveys in Yukon–

Charley Rivers National Preserve in the southern part of Unit 25B resulted in estimated densities of 0.34 moose/mi^2 in 1994 and 0.23 moose/mi^2 in 1997 and 1999 (Burch 1999).

Unit 25D East. A population survey in Unit 25D East in 1995 resulted in an estimate of 704 moose (±33%) in a 1534-mi^2 area (0.46 moose/mi^2) encompassing important hunting areas near Fort Yukon (Table 2). Estimated moose density varied considerably among 3 subunits in the sample area, ranging from 0.12 moose/mi^2 around Fort Yukon to 0.75 moose/mi^2 in the Graveyard Lakes area. A similar survey in 1997 resulted in an estimate of 625 moose (±36%) and a density of 0.40 moose/mi^2. In fall 1999 the moose population in a 2936-mi^2 survey area was estimated at 829 (±20%, no SCF) with an overall density of 0.28 moose/mi^2. A fall 2000 survey resulted in an estimate of 726 (±25%, no SCF). The survey area used beginning in 1999 encompassed the smaller area surveyed in 1995 and 1997. The lower estimated density probably reflected a decline in numbers, lack of a SCF, and the addition of primarily low-density habitat to create the expanded survey area.

The fall 2001 population survey in the 2936-mi^2 area resulted in an estimate at 514 ± 27%. This is lower than 1999 and 2000 estimates. Estimated density in high and low strata was 0.37 and 0.03 moose/mi^2, respectively, with an overall density of 0.18 moose/mi^2 (Table 2). We also calculated a population estimate based on data from sample units representing the area surveyed in 1995 and 1997. This resulted in an estimate of 305 ± 32% moose (0.20/mi^2) in the 1550-mi^2 area. This compares to the 1999 and 2000 estimates of 516 ± 20% and 385 ± 26% and 1995 and 1997 estimates of 704 ± 33% (0.46/mi^2) and 625 ± 36%. These estimates suggest population density has declined from about 0.40 moose/mi^2 in 1995 to 0.20/mi^2 in 2001. Limited snow cover and reduced sightability may have contributed to the relatively low estimate in 2001. A lack of snow precluded fall population surveys in 2002 and 2003, but a spring survey was completed in late March 2004. This resulted in an estimate of 382 ± 20% (0.13/mi^2). This is lower than the most recent fall population estimate of slightly over 500 moose, but sightability in March is significantly lower than during fall surveys (ADF&G, unpublished data).

The total population in Unit 25D East in 1999 was estimated at 2000–3000 moose (no SCF), assuming the population densities estimated in the 1999 survey area (0.13 moose/mi^2 in low strata and 0.28 moose/mi^2 overall) represented the upper and lower limits of moose density in the remaining 8000 mi^2 outside the survey area. Subsequent surveys indicate the total population is currently near or below the lower end of this range.

The apparent downward trend in moose numbers in Unit 25D East probably reflects relatively high adult mortality from predation by wolves and grizzly bears, high hunter harvests and continued predation by bears on moose calves. Many local residents have also reported a decline in moose numbers during the last decade. The population has the potential to increase if cow and calf mortality can be reduced. Encouraging a reduction in predation by increasing local harvest of predators is one of the strategies for increasing moose numbers outlined in the Yukon Flats Cooperative Moose Management Plan.

Unit 25D West. In 1992 a population survey indicated there were an estimated 619 moose (± 21%) in 4544 mi^2 of Unit 25D West (Table 2). Density was 0.14 moose/mi^2. In 1996 we estimated a density of 0.44 moose/mi^2 in a 1531-mi^2 portion of the subunit. The survey area

established in 1996 encompassed much of the high quality moose habitat in the subunit. Poor survey conditions in fall 1998 precluded surveys, but a survey was conducted in Unit 25D West in March 1999. This survey marked a transition to the recently developed spatial analysis survey (GSPE) technique, and employed a somewhat larger survey area that encompassed the previous area. The March survey resulted in an estimate of 735 ± 17%, or 0.32 moose/mi^2, in the 2269-mi^2 survey area (no SCF). A fall 1999 survey in the same area resulted in a population estimate of 862 ± 19%, with a density of 0.38 moose/mi^2 (no SCF, Bertram and Vivion 1999). Data gathered in the part of the area that had been surveyed in 1996 were used to generate an estimate of 0.40 moose/mi^2 (no SCF), which compares to the 1996 estimate of 0.44 moose/mi^2. A fall 2000 survey (no SCF) resulted in an estimate of 670 ± 24% moose in the 2269-mi^2 area, and 555 ± 24% in the original 1774-mi^2 area, suggesting the population was lower than in previous years. A fall 2001 survey (no SCF) yielded an estimate of 668 ± 24% in the 2269-mi^2 area, and 543 ± 25% in the 1774-mi^2 survey area, indicating little change in numbers compared to the previous year. A lack of snow precluded fall surveys in 2002, but a GSPE survey was completed in March 2003 (no SCF; Bertram and Vivion 2003). The area was stratified prior to the survey, which yielded an estimate of 508 ± 29% or 0.22 moose/mi^2 in the 2269-mi^2 survey area, which is lower than the March 1999 estimate of 735 ± 17%. Poor snow conditions again precluded a fall survey in 2003, but a March 2004 survey (no SCF) resulted in a population estimate of 632 ± 20%.

Moose population density in Units 25D East and 25D West continued to be low relative to habitat potential, but it appears that recent population trends and composition may be different in the 2 areas. Survey data suggest moose numbers have declined since 1995 in both Unit 25D East and Unit 25D West, with the steepest decline on the eastern flats. Moose numbers in the western survey area may have stabilized in the last few years, and population density is now higher in this area than on the eastern flats. These trends may be related to differences in the level of harvest as well as other factors. Recent harvest surveys indicate that approximately 150–200 moose are harvested in Unit 25D East each year, while about 60 moose are taken in Unit 25D West. Assuming prehunt populations of at least 2500 moose in the east and 1700 in the west, this suggests harvest rates on the order of 6–8% in Unit 25D East and 3–4% in Unit 25D West.

Population Composition

Units 25A and 25B. Trend surveys conducted by FWS in Unit 25A in 1987, 1989, 1991, and 2000 showed high bull:cow ratios (63–91:100) and moderate calf and yearling survival (Table 1). Moderate to low harvests related to logistic limitations in this remote area suggest that hunting has so far had a minor effect on bull:cow ratios. Surveys have not been conducted in northern Unit 25B in recent years, but surveys in Yukon–Charley Rivers National Preserve indicate calf:cow ratios of 36:100 and bull:cow ratios of 51:100 (Burch 1999).

Unit 25D East. Population parameters in Unit 25D East were calculated based on both estimates (Table 3) and observations (Table 4). Fall calf survival was relatively high in 1999, 2000, and 2001, with estimated calf:cow ratios of 59:100, 49:100, and 43:100. The estimated proportion of calves during these years was 27%, 21%, and 18%. We observed 30 cows with single calves and 8 (21%) with twins in 1999, 25 with single calves and 3 (12%) with twins in 2000, and 24 with single calves and 1 (4%) with twins in 2001. The estimated proportion of

calves has ranged from 7% in 1997 to 27% in 1999. Low calf survival in 1997 was most likely caused by flooding adjacent to the Black River following almost 6 inches of rainfall during 9–15 June. The estimated proportion of calves in the population is likely higher than the proportion observed because there is usually a higher calf:cow ratio in low density habitat, which includes a large area compared to high density areas. Calves composed an estimated 21% of the population in March 2004. One of 18 cows with calves was accompanied by twins in the 2004 survey.

Calf and yearling survival rates were fairly high during 1998, 1999, 2000, and 2001. However, the decline in total population size indicates the absolute number of young moose also declined. The number of bulls, cows, and total adults generally declined during 1996–2001. The decline in the total number of cows and calves was relatively great and accounts for a large part of the reduction in total numbers that appears to have occurred over the last several years (Table 3). The number of bulls in the population appears to have declined to a lesser degree, accounting in part for the increase in the bull:cow ratio over the last several years.

Composition data indicate a relatively high bull:cow ratio, with estimated ratios of 57:100 in 1999, 79:100 in 2000, and 95:100 in 2001. Small, medium, and large bulls were well represented in the population. We observed 24, 19, and 20 yearling bulls:100 cows in 1999, 2000, and 2001 (Table 3).

Unit 25D West. Surveys similar to those in Unit 25D East were completed in Unit 25D West (Tables 3 and 5; Bertram and Vivion 1999; 2000; 2001). Estimated bull:cow ratios in fall 1999, 2000, and 2001 surveys were 31:100, 71:100, and 52:100. We estimated 31 calves:100 cows in 1999, 22:100 in 2000, and 27:100 in 2001. Estimated calf:cow and bull:cow ratios, and the proportion of yearlings were lower in Unit 25D West than in Unit 25D East during 1999–2001 (Table 3). Late winter surveys were completed in March 1999, 2003, and 2004. The estimated percentage of calves in the population was 9% in 1999, 15% in 2003, and 15% in 2004.

Distribution and Movements

Moose are distributed throughout the area, but density varies. Large areas currently support densities of 0.1–0.3 moose/mi^2. Somewhat higher densities occur in localized areas in Unit 25D, particularly in late winter, when moose tend to concentrate in riparian habitat. Moose also concentrate in relatively small areas during early winter along the upper Sheenjek and Coleen Rivers in Unit 25A, but the extent of these concentrations was limited. Telemetry studies in Units 25D East and Unit 25D West indicate some moose are migratory, moving between higher elevation early winter range and low elevation late winter and summer ranges (Maclean and Golden 1991).

In March 1995, FWS initiated a telemetry study to determine moose seasonal movements and distribution, fidelity to winter range, and relationship between fall moose concentrations and harvest in eastern Unit 25A. Fifty-seven moose (44 females and 13 males) were radiocollared in the Sheenjek, Coleen, and Firth drainages and relocated approximately once each month. A strong pattern of annual movement was evident during the 3-year study, with over 40 moose

migrating to the Old Crow Flats in the Yukon in spring and remaining there until late August, when they began moving back into Alaska (Mauer 1998).

MORTALITY

Harvest

Seasons and Bag Limits.

Units and Bag Limits	Resident Open Season	Nonresident Open Season
Unit 25A		
RESIDENT HUNTERS: 1 bull.	5 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep
Unit 25B Porcupine River drainage upstream from the Coleen River drainage:		
RESIDENT HUNTERS: 1 bull.	10 Sep–25 Sep	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		10 Sep–25 Sep
Remainder of Unit 25B		
RESIDENT HUNTERS: 1 bull; or 1 bull per community harvest report by community harvest permit in an established community harvest area.	5 Sep–25 Sep 1 Dec–15 Dec	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		5 Sep–25 Sep
Unit 25D West		
ALL HUNTERS: 1 bull by Tier II subsistence hunting permit only; up to 75 permits will be issued.	25 Aug–28 Feb	No open season
Unit 25D East remainder.		
RESIDENT HUNTERS: 1 bull; or 1 bull per community harvest report by community harvest permit in an established community harvest area.	10 Sep–20 Sep 18 Feb–28 Feb	
NONRESIDENT HUNTERS: 1 bull with 50-inch antlers or antlers with 4 or more brow tines on at least 1 side.		10 Sep–20 Sep

Alaska Board of Game Actions and Emergency Orders. The Yukon Flats moose management planning process resulted in a number of regulatory proposals to the Alaska Board of Game. The board reviewed the draft Yukon Flats Moose Management Plan in March 2002 and addressed proposals relating to moose, wolf, and bear regulations forwarded by the planning team. The board established a 50-inch/4 brow-tine minimum antler size limit for nonresident moose hunters in Unit 25A; changed the moose season from 20 September–30 September to 10 September–25 September in northern Unit 25B; changed the brown bear season in Unit 25D to 1 March–30 November for residents, and 1 March–15 June and 1 September–30 November for nonresidents; designated Unit 25D as a community harvest hunt area with a community harvest permit hunt and season for black bear; added a 1 August–25 September fall baiting season for black bear; and increased the bag limit for wolf hunting from 5 to 10 wolves in Units 25A, 25B and 25D. The board also endorsed the draft management plan as a framework for managing the Yukon Flats moose population.

Hunter Harvest. The reported number of moose harvested was relatively stable in most of Unit 25 during RY96–RY00 (Tables 6, 7, 8). Reported harvest for Units 25A, 25B, and Unit 25D East was 84 moose in RY01 and 95 in RY02. The reported harvest in connection with the Tier II and federal permit hunts in Unit 25D West was small (Table 9), with 4–20 moose reported taken annually during RY98–RY02. The reporting rate in Unit 25D was generally low, but improved somewhat in Unit 25D West through the use of reminder letters and personal contacts. The actual number of moose harvested in Unit 25D West was not well documented, but reports by local governments and preliminary results of the Council of Athabascan Tribal Governments (CATG) harvest monitoring study indicate that about 40 bulls and up to 20 cows were harvested each year during RY99–RY02.

Unreported harvest, particularly by local residents, is common in the upper Yukon River valley. Household interviews conducted by the CATG in the communities of Arctic Village, Beaver, Birch Creek, Canyon Village, Circle, Chalkyitsik, Fort Yukon, Rampart, Stevens Village, and Venetie provided relatively complete information on local moose harvest during RY93 and RY94 (CATG, unpublished data). These harvests included 98 and 84 bulls, respectively. A comparison of these data with harvest tickets returned by local residents indicates only 25–35% of the bull moose harvested by local residents in Units 25A, 25B, and 25D East were reported on harvest tickets. Combining the harvest reported by nonlocal residents with the more accurate data for local harvests obtained in the CATG study indicates the total harvest of bull moose in Units 25A, 25B, and 25D East was at least 152 in RY93 and 149 in RY94. A large proportion of the moose harvest in this region occurred in Unit 25D, where the total harvest in recent years appears to have been about 150–200 annually.

Current information indicates that cow moose were taken at any time of year, especially near communities. While the harvest of cow moose seems to have declined somewhat in recent years, it continues to be a concern to many local residents. Two educational videos were produced in 1993 in a cooperative effort between FWS and ADF&G. The adverse effects of shooting cow moose are a central message in each. These videos have been distributed in local communities and other parts of Alaska and Yukon. The need to minimize the harvest of cow moose has also been a major topic of discussion during the development of a moose management plan.

Permit Hunts. Although local residents largely supported the Tier II moose permit hunt in Unit 25D West, there were a number of problems associated with this hunt (Table 9). These included confusion about differences in applicability of federal and state permits and boundaries of federal and private lands, which are subject to different seasons and/or different permit requirements. These difficulties led to efforts to revise the harvest quota and simplify regulations. The Chalkyitsik Village Council administered a Community Harvest Permit hunt during RY00, RY01, RY02 and RY03. From 12 to 31 people participated in the hunt, with reported harvests ranging from 3 to 12 moose annually (Tables 7 and 8).

Hunter Residency and Success. As in previous years, most hunters reporting from Units 25A, 25B, and 25D during RY01–RY02 were Alaska residents (Tables 10, 11, 12). The proportion of nonresidents was greatest in remote parts of Unit 25A, where guiding activity and float trips were more common. Local residents outnumbered other hunters by a wide margin in Unit 25D East. As described above, the number of local moose hunters was underrepresented because of a low reporting rate. Success among reporting hunters was 41–43% in Unit 25A, 31–33% in Unit 25B, and 16–20% in Unit 25D East.

Harvest Chronology. Most moose taken in Unit 25 were killed during the first 3 weeks of September, with a few reported killed before and after this period (Tables 13, 14, and 15). A number of moose were also taken in late August during the state Tier II and federal subsistence seasons in Unit 25D West. A few moose were reported taken in the 1–10 December open season, but hunting was almost exclusively by local residents during this period, and the number of moose killed was probably greater than reported. CATG harvest studies indicate that local residents harvested moose throughout the year, with the fewest being taken in spring and early summer and the most in late summer and fall (CATG, unpublished data).

Transport Methods. Aircraft were the most common transport mode in Unit 25A, being used by >70% of the successful hunters. Horses and boats were used in most of the remaining hunts (Table 16). Boats were used by at least 75% of successful hunters in Units 25B and 25D East, with airplanes used in about 10% of successful hunts (Tables 17 and 18). Snowmachines were used in taking a small percentage of the moose killed in Units 25B and 25D, but the use of snowmachines and boats was probably underrepresented because relatively few harvest reports were submitted by local hunters.

HABITAT

Assessment and Enhancement

Empirical observations and habitat surveys indicate that the upper Yukon River valley provides excellent moose habitat. Moose populations appear to be well below habitat carrying capacity. As in previous years, moose in Unit 25D appeared to be in excellent nutritional condition. Survey personnel often remark on the relatively large size and rounded contours of both adult and calf moose, noting that most calves were as large or larger than those observed in some other areas.

Habitat surveys indicate that moose browsing intensity is low in both riparian and upland sites and that a large amount of good to high quality forage is available. The occurrence of broomed browse plants is low compared to the Tanana Flats and other areas with high moose

densities and/or more limited range (C.T. Seaton and C. Fleener, unpublished data). Feltleaf willow (*Salix alaxensis*) provides high quality food for moose, and is the most common shrub in riparian habitats. The limited occurrence of moose browsing is reflected in growth form, with extensive stands of 6–50 foot tall feltleaf willows that show little or no evidence of branching due to browsing. Plants only 6–8 feet tall exhibited a mature growth form, also indicating the low intensity of browsing. The mature growth form is rarely observed in young feltleaf willows along the Tanana and Koyukuk Rivers, where moose are more abundant (K. Kielland, personal communication).

Other common trees and shrubs, most of which are potential forage species for moose, include sandbar willow (*S. interior*), little tree willow (*S. arbusculoides*), pacific willow (*S. lasiandra*), blueberry willow (*S. nova-anglii/monticola*), diamond leaf willow (*S. pulchra*), fire willow (*S. scouleriana*), bebb willow (*S. bebbiana*), barren ground willow (*S. brachycarpa*), red osier dogwood (*Cornus stolonifera*), balsam poplar (*Populus balsamifera*), and aspen (*P. tremuloides*). The upper Yukon area has the shortest fire cycle in Alaska; extensive fires have created and maintained large areas of good habitat for moose. The low snow accumulation typical of the area is another factor making the Yukon Flats excellent habitat for moose.

CONCLUSIONS AND RECOMMENDATIONS

Recent population surveys indicate that moose numbers continue to be low and have declined in some parts of Unit 25D, although productivity and recruitment are higher than in some other areas in the Interior. Modest progress was made toward achieving management objectives in some areas, and the Yukon Flats Moose Management planning effort is resulting in some improvements in population and harvest management, specifically related to objectives 3 and 4. Objectives for Unit 25A were generally met, and the harvest of moose in the remainder of the unit was generally sufficient to satisfy local subsistence needs, as well as provide a moderate amount of hunting for other Alaskans and some nonresidents. Declining moose numbers may result in lower harvests in the future.

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TABLE 1 Units 25A and 25B moose observed during early winter aerial composition counts, 1987–2000 (data source: F. Mauer, Arctic NWR)

Area/ Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/mi^2
Unit 25A								
1987[a]	63	9	33		17	124	149	
1989[b]	75	18	29	52	14	315	367	1.01
1991[c]	55		26	8	16	41	49	
1991[b]	91	13	31	44	14	270	314	0.87
1992[d]				8	15	44	52	
2000[b]	81	21	32	25	14	139	180	
Unit 25B[e]								
1987	119	6	10	6	5	105	111	

[a] Upper Sheenjek River only.
[b] Includes upper Sheenjek and Coleen Rivers.
[c] Observed during moose stratification flights in lower Sheenjek, Coleen, and East Fork Chandalar Rivers.
[d] March 1993 survey in East Fork of Chandalar River drainage around Arctic Village.
[e] The only early winter composition count in this area during regulatory years 1986–2002.

TABLE 2 Summary of moose population estimates in Unit 25D East, 1995–2003, and 25D West, 1992–2004

Survey year and type	Survey area (mi²)	Strata size (mi²)			Area searched (mi²)			Total search area	No. of moose estimated by strata and total, and density (moose/mi²)			Total estimate @ 90% CI	Average density moose/mi²	No. of sample units counted
		L	M	H	L	M	H		L	M	H			
Eastern 25D														
1995 Regression Analysis	1534	--	--	--	--	--	--	386	--	--	--	704±33%	0.46	28
1997 Regression Analysis	1534	--	--	--	--	--	--	346	--	--	--	625±36%	0.40	27
1999 GSPE[a]	2936	1828	--	1108	175	--	366	541	229/0.13	--	596/0.54	829±20%	0.28	102
2000 GSPE	2936	1639		1297	218		375	594	368/0.22		359/0.28	726±25%	0.25	112
2001 GSPE	2936	1612		1324	186		419	605	52/0.03		487/0.37	514±27%	0.18	115
March 2004 GSPE	2936	1649		1286	187		413	600	53/0.03		324/0.25	382±20%	0.13	113
1999 GSPE	1550	--	--	--	--	--	--	--	--	--	--	516±21%	0.33	
2000 GSPE	1550											385±26%	0.24	
2001 GSPE	1550											305±32%	0.20	
Western 25D														
1992 Stratified Random	4544	3682	515	348	266	379	343	988	77/0.02	220/0.43	228/0.66	619±21%	0.14	76
1992 Stratified Random[b]	1532	1040	308	184	46	247	184	476	92/0.09	143/0.47	154/0.84	455±33%	0.30	37
1996 Regression Analysis	1532	476	516	539	120	122	124	366	--	--	--	666±21%	0.44	27
March 1999 GSPE	2269	1714	--	554	253	--	264	517	318/0.19	--	422/0.76	735±17%	0.32	96
1999 GSPE	2269	1444	--	825	156	--	345	501	295/0.20	--	567/0.69	862±19%	0.38	93
2000 GSPE	2269	1281		987	124		371	495	124/0.10		553/0.56	670±24%	0.30	
2001 GSPE	2269	1374		865	205		334	539	161/0.12		506/0.56	668±24%	0.29	100
March 2003 GSPE	2269	1682		587	194		264	458	156/0.09		383/0.65	508±29%	0.22	85
March 2004 GSPE	2269	1720		548	216		274	490	310/0.19		319/0.57	632±20%	0.28	91
1999 GSPE	1774											707±19%	0.40	
2000 GSPE	1774											555±24%	0.31	
2001 GSPE	1774	1020		755	156		280	437	104/0.10		428/0.57	543±25%	0.31	

[a] 1999 surveys used smaller sample units, and 2 rather than 3 strata.
[b] Based on sample units counted in the 1992 survey and which later comprised the 1996 survey area.

TABLE 3 Estimated moose population composition based on 1995, 1997, 1999, 2000 and 2001 fall population surveys and a 2004 spring survey in Unit 25D East, and results of fall surveys in 1992, 1996, 1999, 2000 and 2001 and spring 2003 and 2004 surveys in Unit 25D West

Survey period and area (mi²)	Total bulls	Total cows	Total calves	Total adults	Total moose (90% CI)	Bulls: 100 Cows	Yrlg bulls: 100 Cows	Calves: 100 Cows	% Bulls	% Cows	% Calves	Moose per mi²
Eastern Unit 25D												
Fall 1995 (1534)	199	369	136	568	704±33%	54	8	37	28	52	19	0.46
Fall 1997 (1534)	208	372	45	580	625±36%	56	16	12	33	60	7	0.40
Fall 1999 (2936)	218	381	223	599	829±20%	57	24	59	26	46	27	0.28
Fall 2000 (2936)	252	319	156	571	726±25%	79	19	49	35	44	21	0.25
Fall 2001 (2936)	208	217	93	425	514±27%	95	17	43	40	42	18	0.18
March 2004 (2936)	--	--	66	316	382±20%	--	--	--	--	--	21	0.13
Fall 1999 (1550)	141	246	123	387	516±21%	57	24	50	28	48	24	0.33
Fall 2000 (1550)	135	169	81	304	385±26%	79	19	49	35	44	21	0.24
Fall 2001 (1550)	123	130	54	253	305±32%	95	20	42	40	43	18	0.20
Western Unit 25D												
Fall 1992 (4544)	224	317	78	541	619±21	71	12	25	36	51	13	0.14
Fall 1992 (1531)	134	252	69	386	455±33%	53	9	28	30	55	15	0.30
Fall 1996 (1531)	184	340	142	524	666±21%	54	10	42	28	51	21	0.44
March 1999 (2296)	--	--	64	671	735±17%	--	--	--	--		9	0.31
Fall 1999 (2269)	165	529	168	694	862±19%	31	6	31	19	61	20	0.38
Fall 2000 (2269)	247	346	75	593	670±24%	71	12	22	37	52	11	0.30
Fall 2001 (2269)	193	375	100	568	668±24%	52		27	29	56	15	0.29
March 2003 (2269)	--	--	78	430	508± 29%	--	--	--	--	--	15	0.22
March 2004 (2269)	--	--	94	538	632±20%	--	--	--	--	--	15	0.28

TABLE 4 Moose observed in Unit 25D East during early winter moose composition surveys, 1986–2004

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/mi^2
1986	84	13	34	26	15	144	170	0.7
1987	81	18	27	29	13	196	225	0.9
1988[a]								
1989	63	9	41	59	20	235	294	1.0
1990[b]	64	5	32	7	16	36	43	0.7
1991[c]	66	9	26	25	13	168	193	0.7
1992[a]								
1993	38	8	40	37	22	128	165	1.0
1994	68	20	25	24	12	160	184	0.6
1995[d]	50	7	30	39	16	193	232	0.46
1996[e]	54	6	43	16	22	57	73	--
1997[d]	61	18	13	14	8	169	183	0.40
1998[a]								
1999[d]	65	24	45	47	21.5	172	219	0.28
2000[d]	77	19	45	31	20.3	122	153	0.25
2001	103	20	39	26	16	134	160	0.18
2002[a]								
2003[a]								
2004[f]				20		93	113	0.13

[a] No survey.
[b] Poor survey conditions, partial count.
[c] Part of the Graveyard trend area was not completed.
[d] Based on composition observed in population survey, except that estimated density is shown.
[e] Based on limited composition survey in Graveyard and Mardow trend count areas.
[f] March 2004 survey.

TABLE 5 Unit 25D West moose observed during early winter aerial moose composition counts, 1986–2004

Year	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed	Moose/mi^2
1986	78	23	27	20	13	132	152	0.42
1987	71	8	25	13	13	87	100	0.57
1988	84	18	29	13	14	83	96	0.55
1989[a]								
1990[b]	44	12	29	4	15	23	27	
1991[c]	98	8	31	15	13	97	112	0.47
1991[d]	146	8	46	6	16	32	38	0.22
1991[e]	81	8	25	9	12	65	74	1.15
1992[f]	71	12	25	48	13	345	393	0.12
1992[g]	70	11	19	5	10	46	51	0.47
1993[h]	51	14	30	17	16	86	103	0.50
1994[i]	115	23	45	9	14	56	65	0.63
1995[a]								
1996[j]	54	11	42	57	17	273	330	0.44
1997[a]								
1998[k]				26	10		248	0.48
1999[j]	32	6	35	56	21	213	269	0.50
2000	64	7	24	28	13	192	220	0.44
2001	45	9	32	49	18	223	272	0.51
2002[k]								
2003[l]	--	--	--	33	16	168	201	0.37
2004[l]				34	14	209	243	0.42

[a] No survey.
[b] Poor survey conditions, only Meadow Creek area surveyed.
[c] Includes both low and high elevation surveys.
[d] Includes only low elevation count areas (Meadow Creek and Birch Creek).
[e] Mt Schwatka area only.
[f] Data from Unit 25D West census.
[g] Data from Meadow Creek and Mud Lakes trend areas within census area.
[h] Data from Meadow Creek and Mud Lakes trend areas. Mt Schwatka area not surveyed.
[i] Mud Lakes area not surveyed.
[j] Based on composition observed in early winter population survey.
[k] No survey.
[l] Composition observed in March population surveys.

TABLE 6 Unit 25A reported moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Reported[a] harvest			
	M	F	Unk	Total
1986–1987	47	0	0	47
1987–1988	41	0	0	41
1988–1989	39	0	0	39
1989–1990	25	0	0	25
1990–1991	56	0	0	56
1991–1992	47	0	0	47
1992–1993	17	0	0	17
1993–1994	27	0	0	27
1994–1995	24	0	0	24
1995–1996	37	0	0	37
1996–1997	39	0	0	39
1997–1998	31	0	0	31
1998–1999	47	0	0	47
1999–2000	25	0	0	25
2000–2001	31	0	0	31
2001–2002	41	0	0	41
2002–2003	49	0	0	49

[a] Source: moose harvest reports.

TABLE 7 Unit 25B reported moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Reported[a] harvest			
	M	F	Unk	Total
1986–1987	27	0	0	27
1987–1988	26	0	0	26
1988–1999	28	0	0	28
1989–1990	24	0	0	24
1990–1991	47	0	0	47
1991–1992	32	0	0	32
1992–1993	18	0	0	18
1993–1994	43	0	0	43
1994–1995	33	0	0	33
1995–1996	32	0	0	32
1996–1997	20	0	0	20
1997–1998	21	0	0	21
1998–1999	31	0	0	31
1999–2000	36	0	1	37
2000–2001[b]	40	0	0	40
2001–2002[c]	32	0	0	32
2002–2003[d]	34	0	0	34

[a] Source: moose harvest reports.
[b] No moose were reported taken in Unit 25B in Chalkyitsik Community Harvest Permit hunt.
[c] Includes 3 moose taken in Chalkyitsik Community Harvest Permit hunt.
[d] Includes 1 moose taken in Chalkyitsik Community Harvest Permit hunt.

TABLE 8 Unit 25D East reported moose harvest, regulatory years 1986–1987 through 2002–2003

Regulatory year	Reported[a]			
	M	F	Unk	Total
1986–1987	39	0	0	39
1987–1988	47	0	0	47
1988–1999	32	0	0	32
1989–1990	38	0	0	38
1990–1991	52	0	1	53
1991–1992	29	0	0	29
1992–1993	19	0	0	19
1993–1994	27	1	0	28
1994–1995	27	0	0	27
1995–1996	23	0	0	23
1996–1997	14	0	0	14
1997–1998	19	0	0	19
1998–1999	23	0	0	23
1999–2000	16	0	0	16
2000–2001[b]	21	0	0	21
2001–2002[c]	16	0	0	16
2002–2003[d]	24	0	0	24

[a] Source: moose harvest reports.
[b] Includes 3 moose taken in Chalkyitsik Community Harvest Permit hunt.
[c] Includes 2 moose taken in Chalkyitsik Community Harvest Permit hunt.
[d] Includes 11 moose taken in Chalkyitsik Community Harvest Permit hunt.

TABLE 9 Unit 25D West moose harvest for permit hunt TM940 and federal subsistence permits, regulatory years 1989–1990 through 2003–2004

Regulatory year	Permits issued	Did not hunt (%)	Did not report (%)	Unsuccessful hunters (%)	Successful hunters (%)	Bulls (%)	Cows (%)	Unk (%)	Tier II harvest	Federal permit harvest
1989–1990	50	1 (2)	34 (68)	8 (16)	7 (14)	7 (100)	0 (0)	0 (0)	7	
1990–1991	60	9 (15)	44 (73)	3 (5)	4 (7)	4 (100)	0 (0)	0 (0)	4	11
1991–1992	63	44 (77)	0 (0)	13 (23)	6 (11)	6 (100)	0 (0)	0 (0)	6	8
1992–1993	95	67 (71)	2 (2)	21 (22)	5 (5)	5 (100)	0 (0)	0 (0)	5	4
1993–1994	125	53 (42)	21 (17)	41 (33)	10 (8)	10 (100)	0 (0)	0 (0)	10	0
1994–1995	119	65 (55)	14 (12)	30 (25)	10 (8)	10 (100)	0 (0)	0 (0)	10	2
1995–1996	88	43 (49)	3 (3)	26 (30)	16 (18)	16 (100)	0 (0)	0 (0)	16	1
1996–1997	91	32 (35)	18 (20)	31 (34)	10 (11)	10 (100)	0 (0)	0 (0)	10	7
1997–1998	36	23 (64)	0 (0)	11 (31)	2 (18)	2 (100)	0 (0)	0 (0)	2	13
1998–1999	40	21 (53)	1 (3)	11 (28)	7 (18)	7 (100)	0 (0)	0 (0)	7	20
1999–2000	92	55 (59)	0 (0)	24 (26)	13 (14)	13 (100)	0 (0)	0 (0)	13	17
2000–2001	75	41 (55)	4 (5)	21 (28)	9 (12)	7 (78)	0 (0)	2 (22)	9	7
2001–2002	34	15 (44)	6 (18)	9 (26)	4 (12)	4 (100)	0 (0)	0 (0)	4	14
2002–2003	49	23 (47)	6 (12)	16 (33)	4 (8)	4 (100)	0 (0)	0 (0)	4	7[a]
2003–2004	51	30 (59)	7 (14)	10 (20)	4 (8)	4 (100)	0 (0)	0 (0)	4	–[a]

[a] No federal harvest reports have yet been received from Stevens Village for 2002–2003, and federal permit harvest data are not yet available for 2003–2004.

TABLE 10 Unit 25A moose hunter residency and success, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Successful					Unsuccessful					Hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1986–1987	4	22	6	5	37 (60)	2	13	10	0	25 (40)	62
1987–1988	4	16	18	3	41 (61)	4	14	3	5	26 (39)	67
1988–1989	3	19	11	6	39 (57)	2	15	9	3	29 (43)	68
1989–1990	3	12	10	0	25 (52)	4	14	5	0	23 (48)	48
1990–1991	5	27	22	2	56 (72)	1	16	5	0	22 (28)	78
1991–1992	4	21	22	0	47 (57)	0	22	13	0	35 (43)	82
1992–1993	2	7	7	1	17 (35)	5	20	6	0	31 (65)	48
1993–1994	3	13	10	1	27 (51)	0	18	8	0	26 (49)	53
1994–1995	1	14	8	1	24 (55)	2	13	5	0	20 (46)	44
1995–1996	6	11	20	0	37 (62)	2	11	10	0	23 (38)	60
1996–1997	1	6	32	0	39 (58)	2	16	9	1	28 (42)	67
1997–1998	3	13	13	2	31 (61)	0	11	9	0	20 (39)	51
1998–1999	4	17	24	2	47 (64)	0	20	7	0	27 (36)	74
1999–2000	3	4	17	0	24 (45)	3	19	7	0	29 (55)	53
2000–2001	1	15	15	0	31 (37)	0	31	21	0	52 (63)	83
2001–2002	2	15	24	0	41 (41)	2	34	22	1	59 (59)	100
2002–2003	2	20	27	0	49 (43)	3	33	29	0	65 (57)	114

[a] Source: moose harvest reports.
[b] Resident of Unit 25.

TABLE 11 Unit 25B moose hunter residency and success, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Successful					Unsuccessful					Hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1986–1987	9	10	3	5	27 (47)	6	18	2	5	31 (54)	58
1987–1988	9	10	1	6	26 (53)	5	9	6	3	23 (47)	49
1988–1989	9	9	8	2	28 (50)	2	20	6	0	28 (50)	56
1989–1990	7	16	1	0	24 (40)	9	24	1	2	36 (60)	60
1990–1991	9	31	5	2	47 (57)	9	25	2	0	36 (43)	83
1991–1992	9	17	4	2	32 (46)	12	22	4	0	38 (54)	70
1992–1993	6	9	2	1	18 (19)	7	61	4	3	75 (81)	93
1993–1994	13	24	6	0	43 (52)	4	29	5	1	39 (48)	82
1994–1995	6	19	5	3	33 (34)	5	39	14	6	64 (66)	97
1995–1996	6	24	2	0	32 (40)	2	37	9	1	49 (60)	81
1996–1997	6	10	3	1	20 (29)	5	36	7	1	49 (71)	69
1997–1998	7	11	3	0	21 (34)	4	29	8	0	41 (66)	62
1998–1999	10	18	3	0	31 (53)	3	20	2	2	27 (47)	58
1999–2000	7	29	1	0	37 (41)	8	40	5	0	53 (59)	90
2000–2001		25	4	0	34 (48)	1	34	2	0	37 (52)	71
2001–2002	3	21	5	0	29 (31)	5	54	5	0	64 (69)	93
2002–2003	1	29	3	0	33 (33)	4	60	2	0	66 (67)	99

[a] Source: moose harvest reports; does not include moose taken under the Chalkyitsik Community Harvest Permit during RY00–RY02.

[b] Resident of Unit 25.

TABLE 12 Unit 25D East moose hunter residency and success, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Successful					Unsuccessful					Hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1986–1987	23	10	1	5	39 (42)	29	22	1	1	53 (58)	92
1987–1988	24	16	6	1	47 (53)	22	13	3	3	41 (47)	88
1988–1989	18	5	4	5	32 (47)	19	8	4	5	36 (53)	68
1989–1990	24	11	2	1	38 (44)	24	20	5	0	49 (56)	87
1990–1991	35	17	0	1	53 (46)	31	26	4	1	62 (54)	115
1991–1992	17	11	1	0	29 (32)	31	31	0	0	62 (68)	91
1992–1993	10	8	1	0	19 (23)	31	31	3	0	65 (77)	84
1993–1995	14	10	3	1	28 (36)	22	24	0	3	49 (64)	77
1994–1996	16	9	0	2	27 (30)	29	31	3	0	63 (70)	90
1995–1996	17	5	1	0	23 (29)	13	35	7	1	56 (71)	79
1996–1997	7	6	1	0	14 (23)	18	25	4	1	48 (77)	62
1997–1998	13	11	2	0	26 (27)	15	50	5	0	70 (73)	96
1998–1999	13	9	1	0	23 (31)	22	24	5	0	51 (69)	74
1999–2000	5	11	0	0	16 (24)	21	25	4	0	50 (76)	66
2000–2001	3	8	1	6	18 (25)	6	38	9	0	53 (75)	72
2001–2002	6	7	1	0	14 (20)	19	30	5	1	55 (80)	69
2002–2003	5	6	1	1	13 (16)	22	32	12	0	66 (84)	79

[a] Source: moose harvest reports; does not include moose taken under the Chalkyitsik Community Harvest Permit during RY00–RY02.
[b] Resident of Unit 25.

TABLE 13 Unit 25A reported moose harvest chronology[a] percent by month/day, regulatory years 1986–1987 through 2002–2003

Regulatory year	Harvest chronology percent by month/day						
	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5[b]	Unk	*n*
1986–1987	32	43	13	11		2	47
1987–1988	12	34	34	17		2	41
1988–1989	10	54	31	3		3	39
1989–1990	20	36	40	4		0	25
1990–1991	21	54	20	4		2	56
1991–1992	19	43	32	2		4	47
1992–1993	12	41	35	12			17
1993–1994	30	48	19	4		0	27
1994–1995	44	52	4	0		0	24
1995–1996	35	38	16	8		3	37
1996–1997	33	23	35	8		0	39
1997–1998	3	23	39	26		9	31
1998–1999	28	36	30	2		4	47
1999–2000	12	48	28	4		8	25
2000–2001	16	48	29	6		0	31
2001–2002	17	41	37	2	2[c]	0	41
2002–2003	16	47	31	4	0	2	49

[a] Source: moose harvest reports.
[b] No open season.
[c] Harvested out of season.

TABLE 14 Unit 25B reported moose harvest chronology[a] percent by month/day, regulatory years 1986–1987 through 2002–2003

Regulatory year	Harvest chronology percent by month/day							
	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	Dec	Unk	*n*
1986–1987	7	22	52	7	–[b]	0	11	27
1987–1988	8	19	39	19	4[b]	8	4	26
1988–1989	4	41	44	4	–[b]	4	4	27
1989–1990	8	21	42	13	–[b]	17	0	24
1990–1991	11	28	34	13	2	11	2	47
1991–1992	3	41	38	13	0	3	3	32
1992–1993	11	44	17	0	0	28	0	18
1993–1994	12	33	35	12	0	7	2	43
1994–1995	3	38	44	13	0	3	0	33
1995–1996	28	38	25	3	0	6	0	32
1996–1997	25	35	15	5	0	10	10	20
1997–1998	5	5	29	29	19	10	5	21
1998–1999	10	32	39	10	0	6	3	31
1999–2000	8	32	27	11	0	0	22	37
2000–2001	27	11	35	16	0	8	3	37
2001–2002	10	28	38	24	0	0	0	29
2002–2003	6	36	36	15	0	0	0	33

[a] Source: moose harvest reports.
[b] No open season.

TABLE 15 Unit 25D East reported moose harvest chronology[a] percent by month/day, regulatory years 1986–1987 through 2002–2003

Regulatory year	Harvest chronology percent by month/day							
	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	Dec	Unk	*n*
1986–1987	0	56	31	3	–[b]	8	3	39
1987–1988	0	20	53	13	–[b]	7	7	45
1988–1989	0	47	31	3	3	13	3	32
1989–1990	0	45	24	11	3	13	3	38
1990–1991	8	37	40	2	2	6	6	52
1991–1992	17	55	24	3	0	0	0	29
1992–1993	0	42	53	5	0	0	0	19
1993–1994	18	32	29	0	4	11	7	28
1994–1995	8	54	27	8	0	0	0	27
1995–1996	13	43	35	0	0	4	4	23
1996–1997	7	50	29	0	0	0	14	14
1997–1998	0	5	47	37	11	0	0	19
1998–1999	17	57	22	4	0	0	0	23
1999–2000	6	50	31	13	0	0	0	16
2000–2001	5	56	33	0	0	0	5	18
2001–2002[c]	0	43	43	7	0	0	0	14
2002–2003	0	31	46	15	0	0	8	13

[a] Source: moose harvest reports.
[b] No open season.
[c] Seven percent of the moose were harvested in August.

TABLE 16 Unit 25A moose harvest percent by transport method, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1986–1987	72	17	8	0	0	0	0	2	47
1987–1988	61	12	17	0	0	0	2	7	41
1988–1989	61	17	20	0	0	0	5	5	41
1989–1990	56	16	24	0	0	0	4	0	25
1990–1991	61	11	27	0	0	0	0	2	56
1991–1992	77	15	9	0	0	0	0	0	47
1992–1993	76	6	12	0	0	0	0	6	17
1993–1994	56	26	15	0	0	0	4	0	27
1994–1995	75	4	13	0	0	0	9	0	24
1995–1996	62	16	16	0	0	0	3	3	37
1996–1997	69	28	2	0	0	0	0	0	39
1997–1998	65	6	26	0	0	0	3	0	31
1998–1999	68	15	17	0	0	0	0	0	47
1999–2000	64	20	16	0	0	0	0	0	25
2000–2001	77	6	16	0	0	0	0	0	31
2001–2002	80	5	10	0	0	2	2	0	41
2002–2003	71	10	18	0	0	0	0	0	49

[a] Source: moose harvest reports.

TABLE 17 Unit 25B moose harvest percent by transport method, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1986–1987	30	0	63	0	0	0	0	7	27
1987–1988	27	0	65	0	4	0	0	4	26
1988–1989	29	0	61	0	4	0	0	7	28
1989–1990	21	0	75	0	0	0	0	4	24
1990–1991	23	0	68	0	6	2	0	0	47
1991–1992	9	0	78	0	0	0	0	12	32
1992–1993	22	6	61	0	11	0	0	0	18
1993–1994	12	2	77	2	2	2	0	2	43
1994–1995	22	0	73	0	0	0	0	6	33
1995–1996	9	3	75	3	3	0	0	6	32
1996–1997	15	5	75	0	0	0	0	5	20
1997–1998	14	5	71	0	0	0	10	0	21
1998–1999	13	3	81	3	0	0	0	0	31
1999–2000	8	3	73	5	3	0	3	5	37
2000–2001	11	3	81	0	3	0	0	3	37
2001–2002	3	0	93	0	0	3	0	0	29
2002–2003	12	0	82	6	0	0	0	0	33

[a] Source: moose harvest reports.

TABLE 18 Unit 25D East moose harvest percent by transport method, regulatory years 1986–1987 through 2002–2003[a]

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1986–1987	13	0	67	0	5	0	3	13	39
1987–1988	17	0	66	0	6	0	2	8	47
1988–1989	28	0	47	0	16	0	0	9	32
1989–1990	26	0	51	0	13	0	3	8	39
1990–1991	26	0	64	2	2	0	0	6	53
1991–1992	21	0	72	0	0	7	0	0	29
1992–1993	42	0	53	0	0	5	0	0	19
1993–1994	14	0	75	0	4	0	0	7	28
1994–1995	8	0	78	4	0	0	0	11	27
1995–1996	26	0	61	0	0	0	4	9	23
1996–1997	21	0	71	0	0	0	0	7	14
1997–1998	11	0	84	5	0	0	0	0	19
1998–1999	13	0	74	4	0	4	4	0	23
1999–2000	25	0	63	0	0	6	6	0	16
2000–2001	17	0	78	0	5	0	0	0	18
2001–2002	7	0	79	14	0	0	0	0	14
2002–2003	15	0	77	0	0	0	8	0	13

[a] Source: moose harvest reports.

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MOOSE MANAGEMENT REPORT

From: 1 July 2001
To: 30 June 2003[a]

LOCATION

GAME MANAGEMENT UNIT: Units 26B and 26C (26,000 mi^2)

GEOGRAPHIC DESCRIPTION: North Slope of the Brooks Range and Arctic Coastal Plain east of the Itkillik River

BACKGROUND

Moose were scarce in Arctic Alaska prior to the early 1950s, when populations expanded and reached high densities in the limited riparian habitat of major drainages (LeResche et al. 1974). Predation, as well as hunting, probably contributed to the historical scarcity of moose. The reduction in wolf numbers by federal control programs during the late 1940s and early 1950s was probably important in allowing moose populations to increase and become established in most of the riparian shrub habitat on the North Slope. Aerial wolf hunting during the decade following statehood also limited wolf populations.

This area represents the northern limit of moose range in North America. Thus, habitat severely limits the potential size of moose populations, and the concentrated nature of moose distribution and open habitat creates the potential for excessive harvests in accessible areas. During the early 1990s concentration of hunting pressure along these drainages caused concern among guides, outfitters, hunters, and Alaska Department of Fish and Game (ADF&G) and Arctic National Wildlife Refuge (ANWR) staff. Moose hunting regulations became increasingly restrictive during the past decade and a precipitous decline in numbers of moose led to a season closure in 1996.

The following is a review of previous regulations and regulatory changes. The regulatory year (RY) begins 1 July and ends 30 June (e.g., RY00 = 1 Jul 2000 through 30 Jun 2001). During RY90–RY94 the season for Units 26B and 26C was 5–15 September for both residents and nonresidents, with a bag limit of 1 bull. A 50-inch minimum antler size requirement was in effect for nonresidents and also for anyone hunting within the Dalton Highway Corridor Management Area (DHCMA; see below). During RY90–RY92 the definition of a 50-inch moose was an antler width ≥ 50" or 3 or more brow tines on 1 side. In RY93 the definition was changed for moose north of the Alaska Range to a bull with antlers at least 50 inches or 4

[a] This unit report also includes data collected outside the reporting period at the discretion of the reporting biologist.

or more brow tines on 1 side. There was also a winter season of 1 November–31 December, with a bag limit of 1 bull with antlers at least 50 inches or 4 or more brow tines on 1 side, open to residents during RY90–RY94. In RY95 the season remained the same for Unit 26B and the Canning River drainage, part of which is in Unit 26C. The season for residents and nonresidents in Unit 26C east of the Canning River drainage was 5–15 September with a bag limit of 1 bull. The previous antler restriction for nonresidents was inadvertently eliminated due to an error in a proposal that was submitted to the Board of Game in 1994. The winter season for residents was changed to 1–31 December.

State regulations governed moose hunting along the Dalton Highway in Unit 26B through RY95. The DHCMA extends 5 miles from each side of the Dalton Highway from the Yukon River to the Prudhoe Bay Closed Area. The DHCMA was closed to hunting with firearms. However, big game, small game, and fur animals could be taken by bow and arrow. Hunters had to possess a valid International Bow Hunter Education card. In addition, no motorized vehicles, except aircraft, boats and licensed highway vehicles could be used to transport game or hunters.

Kaktovik and Nuiqsut are the only subsistence communities in the area, and residents took 2–6 moose annually prior to the season closure in 1996. Subsistence harvest was small because moose are scarce near Kaktovik and because most hunting by Nuiqsut residents occurred in the Colville River drainage in adjacent Unit 26A.

MANAGEMENT DIRECTION

MANAGEMENT GOALS

- Maintain viable populations of moose in their historic range throughout the region.
- Provide a sustained opportunity to harvest moose.
- Provide opportunity for viewing and photographing moose.

MANAGEMENT OBJECTIVES

- In Unit 26B East allow the moose population to increase to at least 200 moose, with at least 15% calves in spring surveys, before reopening the hunting season.
- In Unit 26B West allow the moose population to increase to at least 75 moose, with at least 15% calves in spring surveys, before reopening the hunting season.
- Once a hunting season has been reopened, maintain a posthunting sex ratio in Units 26B and 26C of 35 bulls:100 cows.

METHODS

The limited and relatively open nature of winter moose habitat on the North Slope makes a total count in trend count areas, rather than random sampling, the most effective population survey method. Moose are limited almost entirely to riparian shrub habitat during winter.

Historically surveys were conducted in Unit 26B East (east of the east bank of the Sagavanirktok, including the Canning River) and in Unit 26C along the Kongakut and Firth Rivers and Mancha Creek. The west bank of the Canning River is the boundary between Units 26B and 26C. However, Unit 26B East (east of the Sagavanirktok River) survey data includes moose counted in the Canning River portion of Unit 26C. Surveys in Unit 26B West (west of the east bank of the Sagavanirktok River) have also been conducted since 1970. Standard surveys began in 1996 and historical data were reanalyzed to allow a comparison with recent data. Moose inhabit different terrain in Unit 26B East and Unit 26B West. In Unit 26B East, moose are found primarily in the northern foothills of the Brooks Range, while in Unit 26B West moose are found along major drainages on the coastal plain.

The U.S. Fish and Wildlife Service conducted moose composition surveys of riparian willow habitat in Unit 26B East (Martin and Garner 1984; Weiler and Liedberg 1987; Mauer and Akaran 1994; Mauer 1995, 1997). Surveys were done during the end of October, early November, April, or May using Piper PA-18 aircraft flown at 70–90 mph, and/or a Cessna 185 flown at 95–120 mph, at altitudes of 300–600 feet above ground level. The following drainages were surveyed as weather permitted: Accomplishment Creek, Lupine River, Saviukviayak River, Flood Creek, Ivishak River, Gilead Creek, Echooka River, Shaviovik River, Juniper/Fin Creek, Kavik River, and Canning River. Aerial observers circled each moose and, during fall surveys, classified moose as calves, cows, yearling bulls, medium bulls (≤50 inch antlers), or large bulls (>50 inch antlers). Medium and large bulls were combined in this report. Spring surveys were completed in 1999, 2000, and 2001 because low snowfall and poor weather precluded fall surveys. The Alaska Department of Fish and Game conducted the surveys in spring 2002, 2003, and 2004, and moose were classified as short yearlings (11-month-old calves) and adult bulls and cows. Because the 2002 survey was conducted in early May, we were able to obtain a minimum estimate of bull:cow and calf:cow ratios.

We conducted spring moose surveys in Unit 26B West in April 1997 and during 1999–2004, using the methods described previously. Surveys were conducted along riparian willow habitat on the Sagavanirktok River from Happy Valley to Sagwon Bluffs and on the Toolik and Kuparuk Rivers starting at approximately 68°52'W latitude to the White Hills. In addition, parts of the Itkillik River have been surveyed periodically since 1981, but because of incomplete surveys during 1996–2004, these data are treated separately.

We conducted habitat reconnaissance in Unit 26B East during the last week of April 1994 in cooperation with the U.S. Fish and Wildlife Service and the University of Alaska. Availability, condition, and species composition of moose browse were evaluated along parts of Accomplishment Creek, Section Creek, and the upper Lupine River.

The hunting season has been closed since fall 1996. Prior to the closure, harvest and hunting pressure were monitored using harvest reports submitted by hunters. Reminder letters were sent to hunters who did not report after the fall season. Population surveys, total harvest, residency and success, chronology, and transportation data were summarized by regulatory year. Informal visits and interviews with hunters and guides also provided insight into population status and moose management issues.

RESULTS AND DISCUSSION

POPULATION STATUS AND TREND

Population Size

A complete moose population survey has not been conducted in Units 26B and 26C, but the nature of terrain and sparse, low vegetation makes it possible for trend surveys to account for a large percentage of the moose in areas supporting major concentrations.

In Unit 26B East, the highest numbers of moose observed were 629 in fall 1988 and 600 in fall 1989 (Table 1). Beginning in fall 1990, the number of moose observed declined markedly to 381 moose and continued to decline to 141 moose by fall 1996. The lowest number of 97 moose observed in fall 1997 should be viewed as an underestimate because 25% of the Canning River was not surveyed. Since 1997, surveys have been conducted in the spring, and the population appears to have increased slowly to 224 moose in 2003 and 234 in 2004 (Table 1). During recent surveys the highest concentrations of moose were found along the Echooka, Ivishak, Kavik, and Canning Rivers. When moose numbers were higher, concentrations also were found along Juniper, Fin, and Gilead Creeks.

In Unit 26B West, excluding the Itkillik River drainage, it appears that moose numbers increased from approximately 100 moose to 165 moose during 1977–1984. The surveys conducted in 1984 and 1989 are comparable to standard surveys that began in spring 1996 (Table 2). Moose numbers appeared to be relatively stable during the mid to late 1980s at approximately 150 moose (Table 2). Information from harvest data, hunting guides, and bush pilots indicated that the moose population in this area declined during the early 1990s, just as it did in Units 26A and 26C. A survey was not conducted until spring 1996 when 53 moose were observed. Surveys conducted during 1999–2000 indicated a stable population of 50 moose, with an increase to about 70 moose in 2001 and 2002 (Table 2). This followed the same trend observed in Unit 26B East, where the population appeared relatively stable during 1996–2002. However, during spring 2003 we observed a substantial increase to 159 moose in Unit 26B West, excluding the Itkillik River drainage. In spring 2004 we observed 117 moose. ADF&G staff also reported an increase in the number of moose observed in Unit 26A, just west of Unit 26B West, in 2003 and 2004 (Carroll, ADF&G, personal communication). Obviously some migration into these drainages occurred, as it was not biologically possible for the current population to produce an additional 100 moose. However, it is difficult to determine where these moose originated, as we have little data on moose movements on the North Slope. Current radiotelemetry data on Colville River moose suggest those moose remain along the Colville River. There was probably some increase in the population that has been residing in the Kuparuk and Toolik Rivers as well. The most likely scenario was that most of the increase in moose numbers came from moose that migrated from Unit 26A, and perhaps a few from Unit 26B East. Some moose may have moved down from the headwaters of the Itkillik River. Most of the moose observed in Unit 26B West were found in the Kuparuk drainage.

Spring surveys conducted along the Itkillik River from the mid 1980s to the mid 1990s indicated moose numbers were stable at about 45 moose (ADF&G files). Although moose did not appear to decline in the early 1990s, as observed elsewhere, beginning in 1999 we

observed only 27 moose and 9, 11, and 27 moose in 2002, 2003, and 2004. Either no surveys or incomplete surveys were conducted in 1996, 1997, 1998, 2000, and 2001.

The decline in moose numbers in the early 1990s appeared to be widespread on the eastern North Slope, as well as in Unit 26A (Carroll 1998). Calf survival was very low during 1993–1996 (Tables 1 and 2; Carroll 1998), and in summer 1995 carcasses of adult moose were found along the Colville River and its tributaries in Unit 26A (Carroll, ADF&G, personal communication). Necropsies revealed that wolves and bears had not killed these moose. Disease may have been involved, because in 1996 and 1997 the bacterial diseases brucellosis and leptospirosis were found in 8 of 43 and 6 of 43 (respectively) live moose that were captured and radiocollared. In addition, a marginal copper deficiency was reported in many of the live and dead moose sampled. Thus, it is possible that disease increased vulnerability to poor environmental conditions during the early 1990s. Winters were long in 1993–1994 and 1994–1995, subjecting moose to shorter growing seasons. Also, in summer 1995 there were numerous reports of intense harassment of moose by mosquitoes. (However, there is no documentation that moose are negatively impacted by mosquitoes). Disease may have also increased vulnerability to predation. Wolves and grizzly bears were common in the region, particularly in the mountains and northern foothills of the Brooks Range, and incidental observations by biologists, hunters, and pilots suggested that wolf numbers increased during the early 1990s. There was some postulation that range deterioration may have been involved. During the late 1980s moose were at the highest densities observed on the North Slope. At the same time the moose were declining, a population explosion of snowshoe hares occurred in some drainages in eastern Unit 26A (Carroll, ADF&G, personal communication). This may have created some competition by affecting the quality of browse. However, habitat reconnaissance east of the Dalton Highway in Unit 26B in April 1994 indicated forage was not in critically short supply even though browsing intensity on favored vegetation was relatively heavy. Species composition consisted mostly of *Salix alaxensis* and *S. pulchra*, with the former predominating. Some current annual growth remained; therefore, some moose browse was still available. Quality of browse was not determined, but *Salix alaxensis* is among the highest quality browse species and the one often favored by moose in Alaska. We assume disease, predation, weather, insect harassment, and range deterioration may all have been involved.

In eastern Unit 26C, sizable concentrations of moose were surveyed in fall 1990 and 1992 in the Kongakut and Firth Rivers and Mancha Creek. However, no surveys have been completed recently, and the status of these moose populations is unknown. A large proportion of the moose in these areas are migratory, moving south and east to the Old Crow Flats in Canada during spring and summer (Mauer 1998). In April 2003 staff from ANWR completed a moose survey in Unit 26C and observed 50 moose.

Population Composition

In Unit 26B East, survival of calves to fall was relatively good (12–14%) from 1988–1991, except in 1989 (5%). No surveys were conducted during RY92 and RY93 and by fall 1994, when the number of moose observed had declined dramatically, survival of calves to fall was very low (4%, Table 1). Low calf survival also occurred in 1995 (5%). A similar pattern was observed during spring surveys in 1994 in Unit 26A, where numbers of observed moose and

survival of short yearlings declined sharply (Carroll, ADF&G, personal communication). Survival of calves to fall improved in 1996 and 1997 in Unit 26B East (11% and 14%, Table 1). Fall surveys have not been conducted since 1997.

During spring surveys in 1999 and 2000, 13% and 8% short yearling moose were observed (Table 1). Short yearlings were not classified in 2001, but we observed 13% short yearlings in 2002 (Table 1). The lowest value of 8% for short yearlings in spring 2000 may have been partly a result of problems with survey methods. Some short yearlings may have been misidentified as adults because observers did not circle and closely examine each moose. In 2003 we observed 18% short yearlings, a considerable increase compared with previous years. This coincided with a higher proportion of short yearlings observed in Units 26B West and 26A. However, survival of calves to 11 months in winter 2003–2004 was poor and only 6% short yearlings were observed in 2004 (Table 1). This did not occur in Unit 26B West (see below) or Unit 26A (~22%; Carroll, ADF&G, personal communication). It is possible that predation by wolves and/or grizzly bears may be higher on the east side because the more mountainous terrain is better habitat for bears and wolves.

In Unit 26B East, bull:cow ratios were below the management objective of 50:100 in fall 1994, but ranged from 61 to 69 during fall 1995–1997 (Table 1). Although bull:cow ratios were high during this time, the population was declining. This suggested that adult cow mortality was higher than adult bull mortality, at least during RY95. However, the season was closed to hunting in fall 1996 and high bull:cow ratios in fall 1996 and 1997 probably resulted from the closed season. We observed a high bull:cow ratio of 72:100 during the 2002 spring survey. This is likely somewhat conservative because we probably misclassified young bulls that lacked early antler development as cows.

In Unit 26B West (excluding the Itkillik drainage), the percentage of short yearlings in the population was very low in spring 1996 (2%). It increased to 23% in 2000, was again low in 2001 (7%), and was relatively high in 2002 (16%; Table 2). In 2003, we observed an increase to 25% short yearlings. This coincided with a substantial increase in the number of moose observed and with moderate–high percent short yearlings observed in Unit 26B East (18%) and Unit 26A (25%). The proportion of short yearlings remained relatively high in 2004 at 18%; but as mentioned above, Unit 26B East experienced a substantial decrease in the proportion of short yearlings observed.

During the 2002 spring survey we observed a bull:cow ratio of 34:100 in Unit 26B West. As was suggested for Unit 26B East, it is possible the bull:cow ratio was higher because we probably misclassified some young bulls as cows. However, the bull:cow ratio was substantially lower than that observed in Unit 26B East. Although we have no data on movements, it is likely that some bulls leave Unit 26B West after the rut and winter in the foothills in Unit 26B East. Data from the 1984 spring survey indicated a bull:cow ratio of 30:100 (ADF&G files), similar to that observed in 2002, although harvest would have influenced the composition observed in 1984.

Distribution and Movements

Moose were generally associated with narrow strips of shrub communities along drainages, except in summer when some dispersal occurred. Historically, the greatest concentrations occurred along the Canning, Kavik, Ivishak, Toolik, Kuparuk, Itkillik, and Kongakut Rivers and Juniper and Fin Creeks. Few moose have been observed on the Itkillik River and no surveys have been conducted on the Kongakut River in recent years. Moose movements have not been intensively studied, but recent surveys indicate there may be extensive movements within or between North Slope drainages. Telemetry studies show that some moose winter in the upper Kongakut River and migrate south and east to summer on the Old Crow Flats in Canada (Mauer 1998).

MORTALITY

Harvest

Season and Bag Limit. There was no open season for moose in Units 26B and 26C during RY96–RY03.

Alaska Board of Game Actions and Emergency Orders. In RY96 the season was closed because of a decline in moose numbers and has remained closed through RY03. During its March 2000 meeting the Board of Game determined that a harvest of 60–80 moose was necessary to satisfy subsistence needs in Unit 26.

Hunter Harvest. The reported moose harvest in Unit 26B was relatively stable during the early 1990s, ranging from 24–37, except in RY92, when harvest was 45 (Table 3). In RY95 harvest declined to 16 animals. The number of hunters increased markedly from 49 in RY91 to 90 in RY92. The number of moose hunters remained high during the following 3 years (63–85), but harvest declined (range = 16–37) to previous levels, probably reflecting the declining moose population.

In Unit 26C the harvest was 3–6 and the number of hunters was 5–12 during RY90–RY95 (Table 4). Compared with Unit 26B, fewer hunters reported hunting in Unit 26C, probably because of a lack of airstrips near moose habitat in Unit 26C and the small number of moose in the area during fall. Most of the hunting in Unit 26C occurred in the Canning River drainage.

Hunter Residency and Success. During RY86–RY96, Alaska residents living outside the area represented all but a few of the resident hunters in Units 26B and 26C (Table 5). Hunter success declined to below 50% beginning in RY93, probably due to the declining moose population. Nonresidents reported a higher success rate than Alaska residents, probably because many nonresidents benefited from guide-outfitter services.

Harvest Chronology. During RY86–RY96 most moose harvested in Units 26B and 26C were taken during the first 2 weeks of September (Table 6). The concentration of hunting activity in early autumn was likely due to early onset of winter in the region.

Transport Methods. During RY86–RY96, aircraft was used by more than 70% of the successful moose hunters (Table 7).

Natural Mortality

No intensive studies of moose mortality have been done in the eastern Arctic. The decline in the early 1990s was probably due to a combination of natural mortality factors, including the bacterial diseases brucellosis and leptospirosis, copper deficiency, weather, insect harassment, competition with snowshoe hares, and predation from bears and wolves.

There is some evidence that recent mortality rates for adult female moose have been low. In Unit 26A along the Colville River the mortality rate for radiocollared moose was 5.7% during RY96, 2.1% during RY97, 0% during RY98, and 11.9% during RY99 (Carroll, ADF&G, personal communication).

CONCLUSIONS AND RECOMMENDATIONS

The moose population in Units 26B and 26C declined dramatically during the early 1990s, probably due to a combination of factors including disease, weather, habitat limitations, insect harassment, and increased predation by wolves and grizzly bears. In Unit 26B, the population was relatively stable at low numbers with slight increases during 1996–2002 (Tables 1 and 2). In 2003 we observed a substantial increase in the number of moose in Unit 26B West, suggesting that moose had possibly migrated into the area. We have little data concerning movement of moose on the North Slope. A radiotelemetry study on Colville River moose concluded that radiocollared moose are residents of the Colville drainage. We hypothesize that some of the increase in moose numbers observed in Unit 26B may have come from Unit 26A; yet during 2003, ADF&G staff also reported increased numbers of moose in Unit 26A (although some of the increase was related to a few good years of calf recruitment). In addition, in 2003 calf survival to 11 months was good in all of Unit 26B (21%). In 2004 Unit 26B West still experienced high numbers of moose (but less than 2003) with good calf survival to 11 months (18%). However, Unit 26B East had poor calf survival at 6% and a slight increase in the number of moose observed. Predation by wolves and grizzly bears may have been higher in Unit 26B East.

We met our first goal of maintaining viable populations of moose in their historic range throughout the region, in part by continuing to keep the hunting season closed until the moose population recovers and our management objectives are met. We did not meet our second goal of providing an opportunity to harvest moose because moose numbers were too low. Moose were available for viewing and photographing, our third goal.

We met our first and second population objectives of at least 200 moose in Unit 26B East and 75 moose in Unit 26B West with ≥ 15% 11-month-old calves in the 2003 survey. In 2004 we were above both population objectives in Unit 26B West with 140 moose observed and 18% short yearlings. However, in Unit 26B East calf survival was poor and we observed only 6% short yearlings; yet the population remained stable at 238 moose. Our third population objective was to maintain a posthunting sex ratio of 35 bulls:100 cows for Units 26B and 26C. Spring 2002 surveys indicated that bull:cow ratios were higher than our objective. Because of the uncertain role the migrated moose will have on the population and poor calf survival in Unit 26B East, we recommend monitoring the population for an additional year before proposing to open a season.

Currently we estimate 700–800 moose in Unit 26A (Carroll, ADF&G, personal communication), 400–500 moose in Unit 26B, and 50 moose in Unit 26C for a total of 1150–1350 moose in Unit 26. There is a customary and traditional use finding for all of Unit 26 for a harvest of 60–80 moose. At a 5% harvest rate, the harvestable surplus is 57–67 moose for Unit 26. We will work with ADF&G/Division of Subsistence when we determine that the population can withstand harvest.

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Publications Technician II

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TABLE 1 Unit 26B East (east of the Sagavarnirktok, including Canning River) aerial moose composition counts, regulatory years 1988–1989 through 2003–2004[a]

Regulatory year	Season	Bulls:100 Cows	Yearling bulls:100 Cows	Calves:100 Cows	Calves	Percent calves	Adults	Moose observed
1986–1987[b]	Fall	57	NA	29	87	15	477	564
1987–1988[c]								
1988–1989	Fall	59	30	21	75	12	554	629
1989–1990	Fall	54	13	9	32	5	568	600
1990–1991[d]	Fall	59	7	26	63	14	383	446
1991–1992[d]	Fall	47	9	21	66	15	452	518
1992–1993[c]								
1993–1994[c]								
1994–1995	Fall	39	8	5	14	4	367	381
1995–1996	Fall	66	11	8	7	5	138	145
1996–1997	Fall	61	5	22	16	11	125	141
1997–1998	Fall	69	4	30	14	14	83	97
1998–1999	Spring	--	--	--	20	13	129	149
1999–2000[e]	Spring	--	--	--	14	8	151	165
2000–2001	Spring	--	--	--	--	--	--	146
2001–2002[f]	Spring	72	-	28	22	13	148	170
2002–2003[f]	Spring	--	--	--	41	18	183	224
2003–2004[f]	Spring	--	--	--	15	6	219	234

[a] Data source for 1988–1989 through 2000–2001: F Mauer, U.S. Fish and Wildlife Service, Arctic National Wildlife Refuge, Fairbanks.
[b] Modified from Weiler and Leidberg 1987.
[c] No survey.
[d] Incomplete survey. Approximately 27% and 19% of total area was not surveyed in fall 1990 and fall 1991, respectively.
[e] Moose were not circled and examined closely, so some calves may have been identified as cows.
[f] Data collected by ADF&G.

TABLE 2 Unit 26B West, excluding the Itkillik River drainage, spring aerial moose surveys, regulatory years 1983–1984 through 2003–2004

Regulatory year	Short yearlings	Percent short yearlings	Adults	Moose observed
1983–1984	32	19	133	165
1984–1985 to 1987–1988[a]				
1988–1989[a]	18	12	131	149
1989–1990 to 1994–1995[a]				
1995–1996	1	2	52	53
1996–1997 to 1997–1998[a]				
1998–1999	6	11	50	56
1999–2000	10	23	34	44
2000–2001	5	7	65	70
2001–2002[b]	11	16	56	67
2002–2003	40	25	119	159
2003–2004	21	18	96	117

[a] No survey.
[b] The Sagavanirktok River was not surveyed.

TABLE 3 Unit 26B reported moose harvest and accidental death, regulatory years 1988–1989 through 2003–2004

Regulatory year	Reported harvest				Hunters
	M (%)	F (%)	Unk	Total	
1988–1989	33 (100)	0 (0)	0	33	49
1989–1990	24 (100)	0 (0)	1	25	47
1990–1991	24 (100)	0 (0)	0	24	45
1991–1992	28 (100)	0 (0)	0	28	49
1992–1993	45 (100)	0 (0)	0	45	90
1993–1994	30 (100)	0 (0)	0	30	84
1994–1995	37 (100)	0 (0)	0	37	85
1995–1996	16 (100)	0 (0)	0	16	63
1996–1997 through 2003–2004[a]					

[a] No open season.

TABLE 4 Unit 26C reported moose harvest and accidental death, regulatory years 1988–1989 through 2003–2004

Regulatory year	Reported harvest				
	M (%)	F (%)	Unk	Total	Hunters
1988–1989	10 (100)	0 (0)	0	10	18
1989–1990	1 (100)	0 (0)	0	1	11
1990–1991	3 (100)	0 (0)	0	3	8
1991–1992	6 (100)	0 (0)	0	6	11
1992–1993	4 (100)	0 (0)	0	4	5
1993–1994	4 (100)	0 (0)	0	4	7
1994–1995	6 (100)	0 (0)	0	6	12
1995–1996	4 (100)	0 (0)	0	4	8
1996–1997 through 2003–2004[a]					

[a] No open season.

TABLE 5 Units 26B and 26C moose hunter residency and success, regulatory years 1988–1989 through 2003–2004[a]

Regulatory year	Successful					Unsuccessful					Total hunters
	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	Local[b] resident	Nonlocal resident	Nonresident	Unk	Total (%)	
1988–1989	0	13	26	4	43 (64)	0	14	6	4	24 (36)	67
1989–1990	0	11	15	0	26 (45)	0	24	7	1	32 (55)	58
1990–1991	0	7	18	2	27 (51)	0	21	5	0	26 (49)	53
1991–1992	1	11	19	3	34 (57)	1	13	10	2	26 (43)	60
1992–1993	0	23	25	1	49 (52)	0	43	2	1	46 (48)	95
1993–1994	2	23	8	1	34 (37)	1	44	11	1	57 (63)	91
1994–1995	0	24	19	0	43 (44)	2	34	15	3	54 (56)	97
1995–1996	0	3	17	0	20 (28)	2	32	17	0	51 (72)	71
1996–1997 through 2003–2004[c]											

[a] Source: moose harvest reports.
[b] Residents of Units 26B or 26C.
[c] No open season.

TABLE 6 Units 26B and 26C moose harvest chronology percent by time periods, regulatory years 1988–1989 through 2003–2004[a]

Regulatory year	Harvest chronology percent by time periods								
	9/1–9/7	9/8–9/14	9/15–9/21	9/22–9/28	9/29–10/5	Oct	Nov	Dec	*n*
1988–1989	42	25	22	11					36
1989–1990	27	31	31	4	4				26
1990–1991	37	52	4					2	27
1991–1992	53	41						6	34
1992–1993	63	37							49
1993–1994	50	44	3					3	34
1994–1995	54	44	3					2	41
1995–1996	37	53	10						19
1996–1997 through 2003–2004[b]									

[a] Source: moose harvest reports.
[b] No open season.

TABLE 7 Units 26B and 26C moose harvest percent by transport method, regulatory years 1988–1989 through 2003–2004[a]

Regulatory year	Harvest percent by transport method								
	Airplane	Horse	Boat	3- or 4-wheeler	Snowmachine	Other ORV	Highway vehicle	Unknown	*n*
1988–1989	83	2	5	0	2	0	7		41
1989–1990	96	0	4	0	0	0	0		26
1990–1991	75	4	21	0	0	0	0		24
1991–1992	76	0	15	0	6	0	0	3	34
1992–1993	84	0	8	0	0	0	8	0	49
1993–1994	71	0	21	0	3	0	6	0	34
1994–1995	74	0	19	0	2	0	5	2	43
1995–1996	90	0	0	0	0	0	10	0	20
1996–1997 through 2003–2004[b]									

[a] Source: moose harvest reports.
[b] No open season.